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NETC TTS-37B

MODEL TTS 37B NOISE-LEVEL-VU MEASURING SET

OPERATING INSTRUCTIONS

1.0 GENERAL

1.01 The Model TTS 37B is a compact, transistorized set designed to measure a wide range of transmission levels, VU, and noise. It has a sensitivity of -80 dbm and 0 dbrn on the meter scales respectively. Switchable filters are provided internally to either attenuate the low frequency band around 60 cycles and its harmonics, or to attenuate frequencies above the voice band; a filter which provides C-message weighting is also included. Provisions for dialing out on a line are available, as is a hold coil for holding the circuit.

1.02 Two monitor jacks are provided. One provides a DC output which may be used to drive a 1 ma recorder. The second jack provides an AC output which may be used to drive an impulse noise measuring set. a telephone headset to determine the nature of the signal, or to drive external circuits, thereby using the Model TTS 37B as a variable, high gain amplifier.

1.03 The sensitivity of the set can be varied from -80 dbm to +20 dbm in one db and 10 db steps by means of two attenuators; these attenuators are also calibrated in dbrn from 0 to 100 dbrn in blue numbers for easy identification. Circuits of either 600 or 900 ohms, balanced or unbalanced, can be measured in either a terminated or a bridging condition.

1.04 Noise to ground can be measured with a 40 db loss; a longitudinal drain is supplied. A BATT TEST push button switch is provided which monitors the condition of the internal batteries and determines if 48 volts is properly connected. A diode is provided to protect the internal circuits against damage in the event the wrong polarity of 48 volts is inadvertently applied.

1.05 The set is equipped with two 9 volt vatteries which provide approximately 150 hours of life. The set can also be operated from 48 volt station battery.

2.0 PERFORMANCE AND SPECIFICATIONS SN 1 → 4300 *

ONE NOTE CAUTION
CHANGES HAVE BEEN MADE ON THIS PAGE.
* SEE ISSUE SHEET.
11/16/93

2.01 Meter

A 4½" meter with several scales is provided as follows:

a. Scale tracking accuracy (+3 to -3 on meter): ±.15 db max error.

b. VU-DB scale calibrated in black divisions and numbers from +3 to -15 db. Between +3 and -3 the scale is calibrated in 0.2 db divisions. 0.5 db divisions are used between -3 and -10 and 1 db divisions are used between -10 and -15.

c. DBRN scale calibrated in black divisions and blue numbers from 13 to -5 dbrn. Between 13 and 7 the scale is calibrated in 0.2 db divisions. 0.5 db divisions are used between 7 and 0 and 1 db divisions are used between 0 and -5.

d. A VU quality scale is marked in three colors:
Green between 0 and +3 db
Yellow between -6 and 0 db
Red between -15 and -6 db.

e. A BATT TEST scale with a green arc to indicate GOOD

2.02 Range of Measurements

a. Level Measurements: +23 dbm to -95 dbm

b. Noise Measurements: 113 dbrn to -5 dbrn

c. Noise to Ground Measurements: 113 dbrn to -5 dbrn

2.03 Input Impedances

Balanced input transformer:

a. Terminated: 600 or 900 ohms ±5%, with a phase angle of less than 5° when hold coil is out

b. Bridging: 12,000 ohms on 600 ohm circuit
15,000 ohms on 900 ohm circuit

c. Longitudinal Drain: Across the line - 85,000 ohms
To ground - 100,000 ohms

2.04 Frequency Response

The frequency response for designated positions of the FILTER switch, normalized to 1 KC at room temperatures, is as follows: (see figures 9 and 10 for typical curves)

C-MSG: -3 db from 625 to 675 cps and 2800 to 3100 cps
-40 db from 85 to 115 cps and 6000 to 7000 cps

HIGH PASS: Not less than 45 db rejection at 60 cps
-3 db from 13 KC to 16 KC with 18 db per octave slope at higher frequencies

3 KC: ±0.15 from 300 to 1500 cps
-3 db from 2.8 KC to 3.2 KC with 18 db per octave slope at higher frequencies

15 KC: ±0.15 db from 300 to 5000 cps
-3 db from 13 KC to 16 KC with 18 db per octave slope at higher frequencies

2.05 Attenuator Accuracy: (Reference to 0 dbm setting)
±0.15 db from +10 db to -60 db.
±0.3 db from +20 db to -70 db.

2.06 Hold Circuit

A low resistance hold coil can be switched in or out. At frequencies below 200 cps this coil will have an effect on the response characteristic and will therefore affect the accuracy of measurements.

2.07 AC Monitor Output

a. Output Impedance: 600 ohms

b. Output Level: -10 dbm when meter reads 0 db

2.08 DC Monitor Output

a. The DC output is approximately 0.8 ma when meter reads 0 dbm.

b. The DC resistance of the external measuring circuit, such as a recorder, should not exceed 300 ohms and must be isolated from ground.

2.09 Stability of Calibration

a. Stability with Temperature (30°F to 120°F, with respect to readings at 72°F): ±0.15 max. change.

b. Stability with Battery Voltage (within green BATT TEST arc on meter): ±0.1 db max. change.

2.10 Power Requirements

a. Battery Operation: Required two 9 volt Eveready 2356 batteries or equivalent. Current drain 20 ma (without AC mon).

b. Battery Life: Intermittent use -- approximately 150 hours
Continuous use -- approximately 100 hours

c. 48 Volt Operation: Requires 48 volt office battery
Current drain 50 ma

2.11 Size

8" x 11" x 10"

2.12 Weight

13 pounds

3.0 CONTROLS AND TERMINALS

The following controls and terminals are available:

3.01 Controls

1. Step Attenuator: 0 to -10 dbm and 10 to 0 dbrn in 1 db steps (dbrn markings are in blue)

2. Step Attenuator: +20 to -70 dbm and 90 to 0 dbrn in 10 db steps (dbrn markings are in blue)

3. Filter Selector Switch: C-Message, High Pass, 3 KC, 15KC

4. Input Selector Switch: Dial and Talk
   900 ohms bridging
   900 ohms term.
   Noise to ground
   600 ohms term.
   600 ohms bridging

5. Hold: ON-OFF

6. Power: ON-OFF

7. Battery Test Switch

3.02 Terminals

Two binding posts for LINE
Jack for LINE
Jack for Dial or Tel Set
Binding post for GROUND
Jack for EXT 48V power - T=Neg, S=Gnd
Jack for AC monitoring
Jack for DC monitoring
All jacks accept type 310 plugs

4.0 CIRCUIT DESCRIPTION

Schematic Diagram

4.01 The schematic diagram of the instrument is shown in Figs 1 through 6.

4.02 The gain of the set is obtained from three amplifiers. Each amplifier is enclosed with a large amount of negative feedback to insure gain stability. The inherent noise level of the set is at least -100 dbm and approaches -120 dbm when the C-message filter is used. The circuit can be divided into the following basic elements:

a. Input Circuit
b. 10 db Step Attenuator
c. Amplifier 1
d. Filter Switching Network
e. 1 db Step Attenuator
f. Amplifier 2
g. Amplifier 3
h. Metering Circuit
i. Monitoring Circuits
j. Power Section

4.03 Input Circuit (Fig. 1)

The input line connections are made to a balanced transformer with DC blocking capable of withstanding 150 volts DC of either polarity. Terminating resistors for 600 and 900 ohm input impedances can be switched directly across the input line and the DC blocking is still maintained. These resistors are switched at the equal potential or center-tapped point to maintain balance. The hold coil, which can be switched across the line, is also switched at the center-tapped position for the same reason. The input circuit is balanced at least 80 db at 60 cps, 70 db at 1000 cps, and better than 60 db up to 10 KC.

4.04 A longitudinal drain, whose center tap is connected to ground through a resistor, is supplied.

4.05 The transformer has a 1:1 ratio. Since the secondary of this is loaded by a high impedance, the primary of the transformer also looks like a high impedance. This reflected impedance is seen in the bridging positions of the INPUT switch. It is nominally 12,000 ohms for 600-ohm circuits and 15,000 ohms for 900-ohm circuits; the bridging losses will be less than 0.2 db for frequencies down to approximately 100 cycles.

4.06 10 db Step Attenuator

This is a three-section attenuator which is the main sensitivity adjustment of the set. 30 db is available in one section and is merely a tapped voltage divider. Two other sections, each having 30 db loss, can be switched ahead of this. For the first 30 db of loss the tapped voltage divider only is used. For 40 db of loss, which corresponds to the -30 db position of the SENS control, a single 30 db section is placed ahead of the step voltage divider and 10 db of loss is brought into the output section. Thus the stepped divider is used for the 10 db steps, and the other two sections are brought in as necessary to extend the range of these 10 db steps. 1% resistors are used, which assures an attenuator accuracy better than ±0.15 db. Normally the accuracy is better than this, particularly at the higher sensitivities.

4.07 Amplifier 1 (Fig. 2)

Amp 1 is basically a two-stage voltage amplifier with negative feedback. An emitter follower is incorporated in the output stage since this amplifier drives the filter sections.

4.08 Q102, Q103, and Q104 comprise the amplifying section. Q102 is a conventional common emitter whose bias is obtained from the collector for DC stabilization. Q103 is also operated in the common emitter, but since this is also an NPN, bias conditions and polarities are reversed. Q104 operates as a common collector or emitter follower to isolate the filter impedances from the collector of Q103 to which it is DC connected. The emitter current of Q104, both AC and DC, is eventually returned to a resistor which is common to the emitter of Q102; this comprises negative feedback. For the circuit shown approximately 30 db of feedback is achieved and is effective over the entire band of frequencies. The two diodes in the emitter of Q104 are a battery compensating network. If the battery voltage decreases, the emitter current of Q104 will also decrease. This raises the impedance of these two diodes, which decreases the negative feedback by a slight amount, thereby keeping the overall gain of the set relatively independent of the battery voltage. The emitter of Q104 supplies an output through an RC network which keeps DC and voltage transients producing by switching from subsequent stages. The nominal output impedance of the amplifier is in the order of 5 ohms, due to its emitter follow type output and heavy amounts of feedback. A series resistance is used to bring this up to a value to match the filter characteristices, which is basically 600 ohms.

4.09 Filter Switching Network

This selects the proper components to produce the responses shown in Figs. 9 and 10.

4.10 1 db Step Attenuator

This is a conventional stepped voltage divider which presents a 600-ohm impedance to the filter and is terminated by the high impedance of Amp 2. One percent resistors are used, which assures an accuracy better than ±0.15 db. Normally the accuracy is better than this, particularly at the higher sensitivities.

4.11 Amplifier 2 (Fig. 4)

This is a three-stage amplifier incorporating negative feedback consisting of Q201, Q202, and Q203. Overall feedback is applied from the emitter of Q203 to the emitter of Q201, while the output is taken from the collector of Q203. Q201 is a conventional common emitter amplifier with collector to base bias. Q202 is also a common emitter configuration, but since this is an NPN, the emitter is returned to battery while the collector is returned

to ground. The output of Q202 which appears at its collector is direct coupled to the base of Q203. This is also of the common emitter configuration. The emitter of Q203 contains a large amount of DC resistance to give the proper amount of current when its base is connected to the collector of Q202. Most of this resistance is bypassed by C203 so that degenerations at signal frequencies will not occur at this point. The unbypassed part of the emitter resistance is R209, which is common to the emitter of Q201. This provides overall loop feedback which stabilizes the gain of the entire amplifier.

4.12 Amplifier 3 (Fig. 5)

Amplifier 3 consists of Q301 and Q302. Both are operated as common emitters with bias derived from the collector for DC stabilization. The output of Q302 is applied to the diode bridge which is returned to the emitter of Q301 and thus supplies negative feedback. The operation of such a network can be best described on a half cycle basis. When the signal at the collector of Q302 is a negative half cycle, CR302 will not conduct, due to its polarity connection. CR301 will conduct. The signal, however, cannot go through CR303. It can go through the meter and through CR304 back to the emitter of Q301. Note that wave current is from right to left through the meter.

4.13 When the collector Q302 goes positive, similar reasoning will show that the path of conduction will be through CR302, the meter, CR303 back to the emitter of Q301. Note that on this half cycle the meter also conducts from right to left. Thus the meter has a pulsating of full wave type current. The ballistics of the meter will ignore the peaks and respond to the average value of DC. The meter is calibrated so that this average value reads in RMS value. The characteristics of such a circuit linearize the resistances of the diodes. For instance, as the resistance of the diodes increase, either due to temperature changes or to decreased meter current, the feedback is automatically adjusted so that the meter current is a linear function of the input voltage. This is true for wide ranges of temperature and also true for greatly mismatched diodes, thus the circuit is relatively uncritical either to component values or diode voltage current relationships.

4.14 The use of the diode bridge in the feedback loop produces two results. The bridge is loading the output of Q302; since it is a non-linear bridge, it can be expected that the waveform at Q302 will be distorted. This is true, and the waveshape appears as a flattened sine wave with very sharp edges around the center of the curve. The edges are produced by the fact that for a fraction of a volt on either side of zero the diodes are not conducting and unload the collector circuit. The flattening is a result of the fact that the diode resistance goes down as the voltage goes up. It therefore tends to flatten out the peaks of the sine wave. The feedback mechanism produces a linear current through

the diodes. The two half cycles of current are recombined at the emitter of Q301 to form a perfect sine wave.

4.15 Metering Circuit

The meter is used for two functions. One is to measure the level applied to the line terminals of the set and under this condition it is applied to the diode bridge of Amplifier 3. It is also used for battery test at which time it is disconnected from Amplifier 3 and connected between battery and ground through a dropping resistance which converts the milliamp meter into a voltmeter to monitor the condition of the battery.

4.16 The ballistics of the meter are similar to those of a VU meter.

4.17 Monitoring Circuits

The DC MONITOR jack provides means to connect an external milliamp meter or recorder in series with the meter of the set. See. Fig. 6. The characteristics of Amplifier 3, with the diode bridge incorporated in the feedback loop, produce a high impedance or constant current source for the meter. Thus, the external meter can have a wide range of resistance. It is advisable, however, to insure maximum accuracy of the reading, to keep this resistance of the external meter recorder below 300 ohms. It is also necessary, again due to the manner in which the DC current is developed, to keep the external meter or recorder off ground electrically, since otherwise part of the feedback will be shorted out. Whenever the meter reads 0 dbm, the available current is slightly less than 1 ma.

4.18 The AC MONITOR consists of Q303, which samples part of the signal available in Amplifier 3, amplifies it, and provides a given source of impedance available to the AC MONITOR jack. See Fig. 5. The signal which this amplifier samples is at the emitter of Q301 in Amplifier 3. This is a low impedance point, a sine wave, and is still a direct function of the signal appearing at the line jacks. The input impedance of the monitor amplifier, 0303, is high enough so that it does not shunt the emitter resistance of Q301, and therefore it does not materially influence the amount of feedback or the value of the gain of either Amplifier 3 or the entire set. To conserve internal battery power, the collector supply of Q301 is normally cut off until the plug is inserted into the AC MON jack. The signal available at the AC MON jack is DC blocked so that a DC resistance can be inserted between the tip and ground of the jack. This DC blocking is done by an electrolytic which means that if any DC voltage should be applied to the tip of the AC MON jack, it should not exceed 9 volts negative or 12 volts positive.

4.19 The frequency response of the monitoring circuit is -3 db at 100 cycles and 15 KC for the flat 15 KC position. For other

filter positions, the response at the monitor jack is identical with the response to the meter. Signal to noise output at this jack will always be better than 30 db for meter readings of at least -3 dbm. The output level is -10 dbm when the meter reads 0 dbm.

4.20 Power Section

For an amplifier with this much gain and with such a low frequency response, it is necessary to insure that there is no impedance in common with the amplifier supply. Since certain areas of these amplifiers have bandwidths which extend down to 1 cycle, ordinary RC coupling is inadequate except with extremely large values of capacitance. The decoupling in this set may appear slightly unconventional, in that Amplifier 1 and Amplifier 2 are decoupled from the battery supply by a transistor, Q1. See Fig. 6. Essentially this transistor is operated as a series device although strictly speaking it can be considered as an emitter follower. It operates with sufficient base bias to insure saturation and very little collector to emitter voltage drop, and with a capacitor, C2, from base to ground. The base is held relatively fixed by this capacitance and the emitter must follow the base. The effect of such a circuit is the same as a conventional RC decoupling network except that the RC product is effectively increased by the beta of the transistor. In other words, we get the same amount of decoupling with 100 mfd as we would with 5000 mfd in conventional RC decoupling.

4.21 Amplifier 3 is supplied through a conventional RC decoupling, the chief function of which is to keep the battery impedance relatively constant and insure that no local feedback introduced by an aging battery will seriously affect the low frequency response.

4.22 When a plug with 48 volts of the proper polarity is inserted in the 48-volt jack, CR1 will conduct and CR2, a zener diode, will conduct in the reverse direction and maintain a constant voltage. R10 limits the amount of current through the zener diode to a proper value. The use of the zener and the series transistor filter produces sufficient filtering so that the proper signal to noise will be obtained, provided the noise on the station battery does not exceed 1 volt peak to peak at 10 cycles or higher. When 48 volts is applied to the set, the battery is disconnected.

4.23 The battery test resistor is connected to the meter from the zener diode. This is the primary point of power application whether it is from internal or external batteries. Notice that the reading of the battery test can only occur when the power switch is on the thus represents a load on the batteries.

5.0 MAINTENANCE

5.01 In the event of a grossly inaccurate or missing meter reading the following can be checked.

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5.02 Batteries. These should always be checked first. This is conveniently done by depressing the BATT TEST button and observing a meter deflection within the green arc. To replace batteries, remove the four screws (#10) which hold the front panel to the case. Lift the panel (and attached components) directly out of the case. Disconnect the red and black wires from the batteries. These can be unsnapped with slight finger pressure. Remove the two screws which hold the metal plate over the batteries. The old batteries can now be removed and fresh ones installed in the same place. Unsnap the black strap from the two old batteries and snap this to the new batteries. (This cannot be done except to the correct terminals.) Fasten the metal plate back to hold the batteries. Reconnect the red and black wires to the batteries. (These also can only be connected properly.) Being careful not to short the components on the set, turn the POWER switch ON and depress the BATT TEST. Deflection of the meter into the green arc indicates all is proper. Turn POWER off. Replace the set in the case. Refasten the panel to the case with the four #10 screws. (It is usually wise to secure the threads of all four before tightening.

5.03 FUNCTION Switch - To be in the proper position.

5.04 SENS - To be of sufficient sensitivity to give a reading.

5.05 INPUT - Connected to the proper jack or pair of terminals.

5.06 DC MON - If a plug is inserted, it must have a low DC resistance.

5.07 FILTER - Set to allow the frequency of the input signal to pass.

5.08 Should all connections and settings be proper and no meter reading occurs, the circuitry can be checked. The following checks are made with a 1000 cps signal applied at 0 dbm level.

5.09 Input Circuit - Put SENS in -70 dbm position. Turn POWER OFF. With either a VTVM or oscilloscope (CRO) trace the path of the signal. With the CRO grounded to case, look at pin 7 of the transformer. The signal should be approximately 2 volts peak to peak. This should also appear at S7 on the wiper of the second deck from the chassis, and the wiper of the deck farthest from the chassis. (If the FUNCTION switch is on 600 either BRIDGING or TERM, the signal at S7 will be slightly less than at T1). The signal at S7 should also appear at the base of Q2. This is point R on the printed circuit board. (Figs. 7 and 8 show the layouts of the two printed circuit boards with significant points indicated.)

5.10 Amp 1 (Q102, Q103, Q104) - Set SENS to -40 dbm. The CRO should have a deflection sensitivity of at least 0.1 volt/cm. Place the CRO input at point O. This is the output of Amp 1. The level here should be approximately 0.2 volts peak to peak. If it

is, Amp 1 is satisfactory. If there is no output or it is very low, proceed with the next step.

5.11 Amp 1 DC - Measure (20,000 ohms per volt--no less than 10 volts full scale) the collector voltages of Q102 and Q103 as shown on the schematic. These DC voltages are for a fresh set of batteries.

5.12 Filter - If the signal appears normal at point 0, check point T, it should be approximately 0.06 volts peak to peak.

5.13 Amp 2 - If the signal is normal to point T, place SENS on 0 dbm and check the level at the collector of Q203; it should be approximately 0.15 volts peak to peak. If not, check the DC voltages of Amp 2 as shown on the schematic.

5.14 Amp 3 - If the point in step 5.13 is normal, check, with the CRO, the level at C304. This should be approximately 1.5 volts peak to peak and appear flattened. If not, check the DC voltages of Amp 3 as shown on the schematic.

Calibration

5.15 No external calibration control is available. Normally no calibration is required, as the set is extremely stable and should hold its calibration for a long period of time. It may be desirable to make a routine check periodically to determine if there has been any change in calibration.

5.16 The calibration is checked by applying an extremely accurate 0 dbm 1000 cps signal to the line jack and setting both attenuators at 0 dbm. The meter should read 0 db. If it does not, the set should be recalibrated.

5.17 To calibrate the set, remove the set from its case. Apply a 1 mw 1000 cps signal to the line jack and adjust R308, which is located on the amplifier board until the meter reads 0 db.

6.0 OPERATION

6.01 Level Measurements

1. Open lid. (May be detached by moving lid to the right.)
2. Turn POWER switch ON.
3. Depress BATT TEST key and note if meter needle falls in green arc marked GOOD. Replace batteries with Everady 2356 or equivalent if Step 3 indicates bad.
4. Set INPUT switch to desired impedance.
5. Set FILTER switch to desired filter.

6. Connect circuit to be tested to either the LINE jack or LINE binding posts.

7. Set SENS attenuator switches to obtain a convenient reading on the meter. A more accurate measurement may be obtained if the meter needle falls between the black numerals +3 and -3 dbm.

8. The level is the algebraic sum of the SENS switches reading (WHITE NUMBERS ONLY) and the meter reading (BLACK NUMBERS ONLY). Likewise, the SENS switches readings are the algebraic sum of the white numerals.

   Example:

SENS Switches	Meter Reading	Level
+7 (WHITE)	+2 (BLACK)	+9
+15 (WHITE)	-3 (BLACK)	+12
0 (WHITE)	-1.6 (BLACK)	-1.6
-10 (WHITE)	+2.4 (BLACK)	-7.6
-15 (WHITE)	-0.6 (BLACK)	-15.6

9. To monitor the tone being measured, insert a 310 plug connected to a telephone headset in the MON AC jack. (This output jack can be connected to a 600 ohm impedance receiving device with little effect on the meter reading.)

6.02 Noise Measurements

1. Follow Steps 1 through 6 under 6.01, Level Measurements.

2. Set the SENS switches to 85 (blue numbers).

3. Connect circuit to be tested to either the LINE jack or LINE binding posts.

4. Reset SENS switches to obtain a convenient reading on the meter, preferably between 7 dbrn and 13 dbrn (blue numbers only).

5. The noise reading is then the algebraic sum of the SENS switches reading (BLUE NUMBERS ONLY), and the meter reading (BLUE NUMBERS ONLY).

   Example:

SENS Switches	Meter Reading	Noise Level
27 (BLUE)	7 (BLUE)	34 DBRN
35 (BLUE)	10 (BLUE)	45 DBRN
22 (BLUE)	12 (BLUE)	34 DBRN

6. To monitor the noise being measured, insert a 310 plug connected to a telephone headset in the MON AC jack. This output jack can be connected to a 600 ohm impedance receiving device with little effect on the meter readings.

NOTE 1: When recording noise measurements, the type of filter should be indicated such as 42 dbrn-C-MSG or 85 dbrn 15 KC flat.

NOTE 2: To make "noise to ground" measurements, set input switch to N-GND and connect a good ground to the GND binding post.

6.03 VU Measurements

1. Follow Steps 1 through 7 under 6.01, Level Measurements.

2. Set SENS switches to white numerals to obtain reference point.

3. Meter needle deflections into the green (0 db to +3 db) and yellow (-6 db to 0 db), or red (-15 db to -6 db), arcs may now be noted.

6.04 To Talk

1. Set INPUT switch to DIAL AND TALK.

2. Connect a telephone headset to the DIAL jack.

3. Connection is now established to the circuit connected to the LINE jack.

NOTE: Circuit under test must supply DC talk battery.

6.05 To Dial

1. Set INPUT switch to DIAL AND TALK.

2. Connect a dial or subscriber's set with a dial to the DIAL jack.

3. A number may now be dialed on the circuit connected to the LINE jack.

6.06 To Hold and Release

1. Operate HOLD key to ON to hold a circuit, OFF to release.

NOTE 1: The HOLD circuit when ON will hold a circuit connected to the LINE jack when the INPUT switch is in any position.

NOTE 2: The HOLD coil may be influenced by strong magnetic fields. This normally occurs in the more sensitive positions. Relocation of the set away from the field, orientation within the field, or operation on HP or C-MSG will reduce the effect.

6.07 To Operate on 48 Volts

1. Insert a cord in jack marked 48V FIRST; the tip must be connected to battery and the sleeve to ground.

2. Connect other end to 48-volt supply.

3. Operate POWER switch to ON.

4. Depress BATT TEST key and observe correct polarity and voltage by the meter needle swinging to the green GOOD arc.

6.08 To DC Monitor or Record

1. Follow normal procedure under 6.01, 6.02, and 6.03.

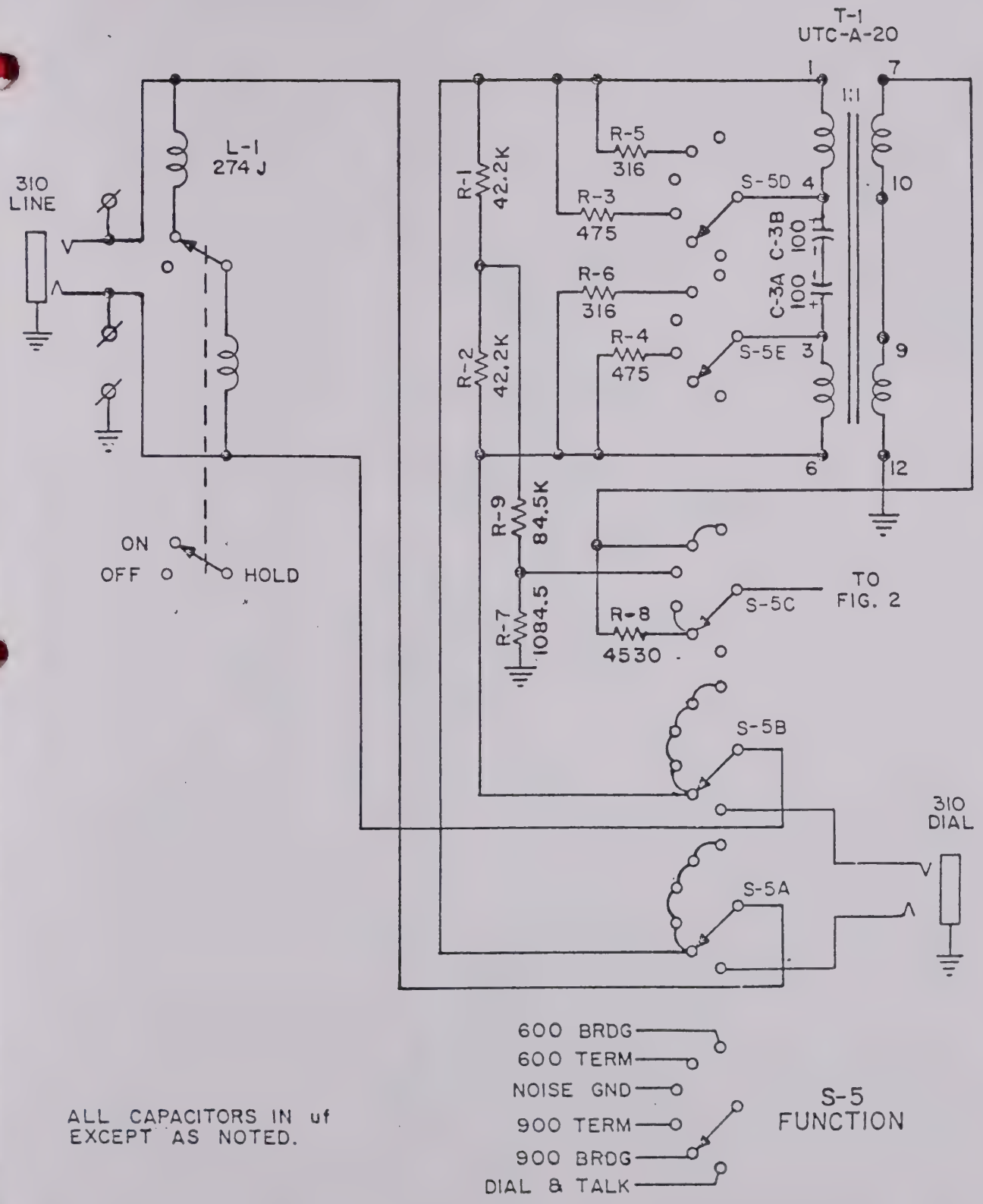
CAUTION: The external DC monitor (recorder or meter) device must have a relatively low resistance (not over 300 ohms) and must be isolated from ground.

2. Connect monitoring device to the MON 1 MA jack (tip and ring). If the monitoring device's resistance is right, there will be no change in reading on the TTS 37B meter.

3. Calibrate external monitor. (0 db will produce between 0.7 ma and 1 ma.)

6.09 Storage

Always attach lid to test set when not in use. This automatically turns POWER switch to OFF position when it is closed.

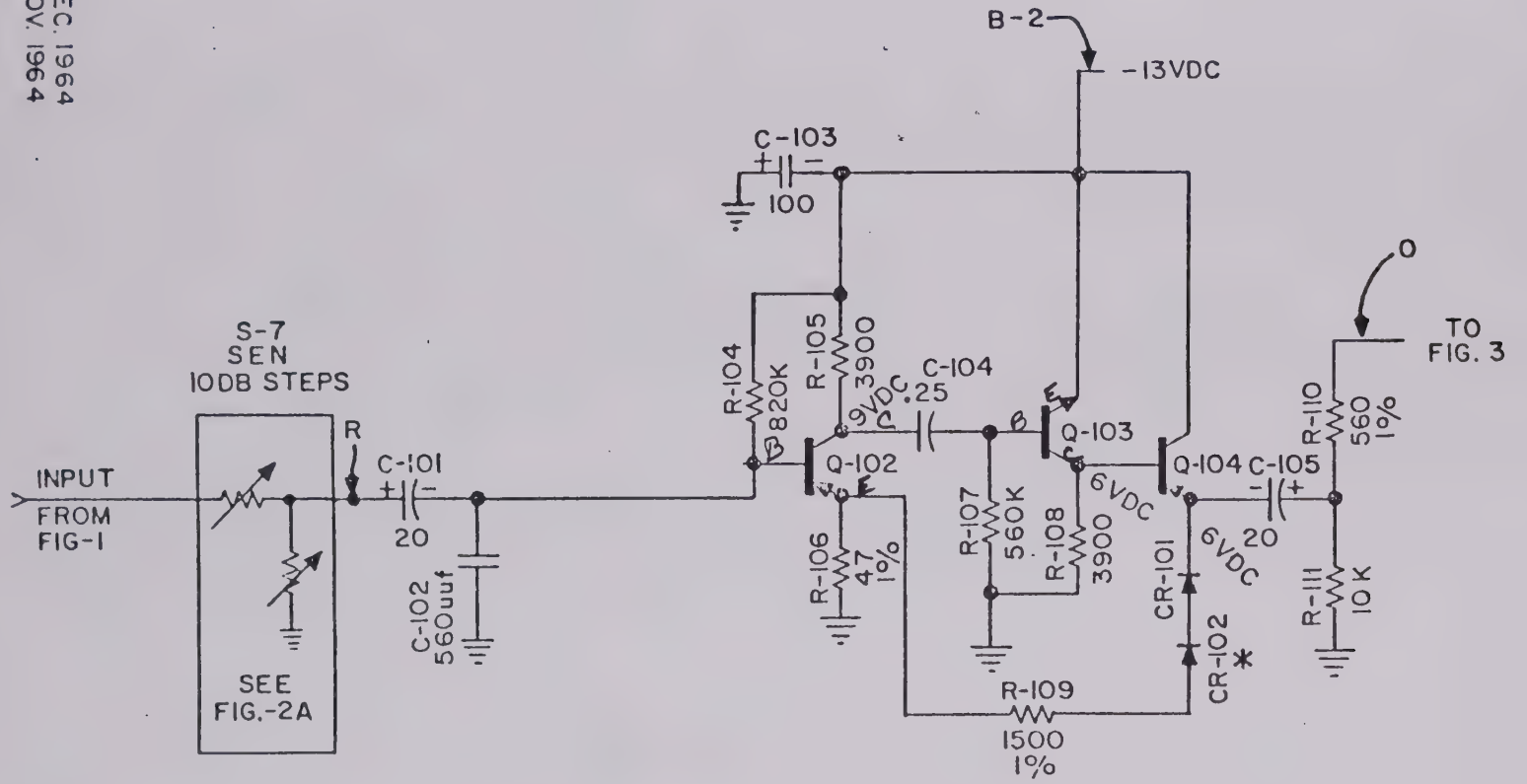


ALL CAPACITORS IN uf
EXCEPT AS NOTED.

REV. DEC. 1964
REV. 2
MARCH 1964

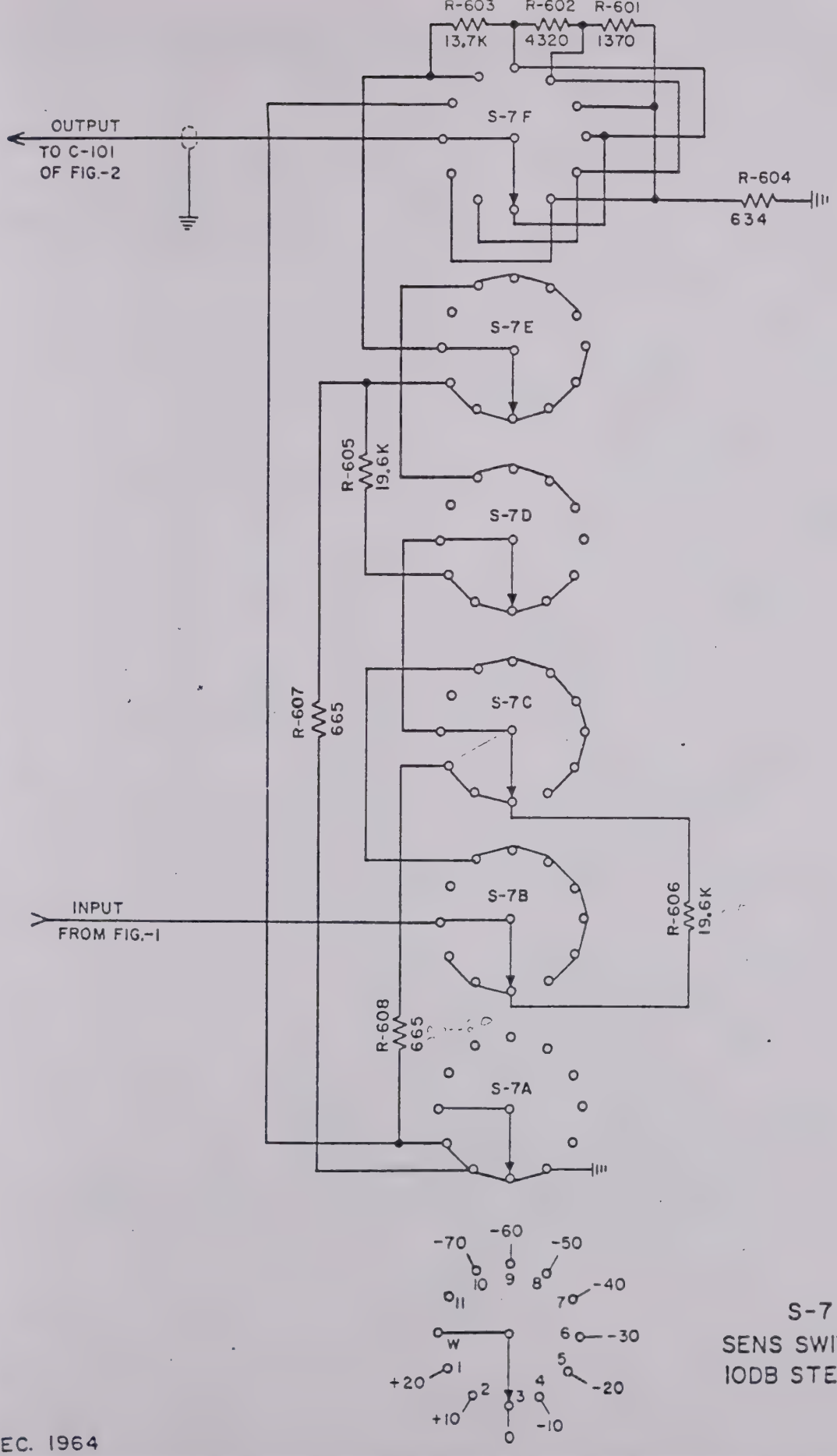
FIG. 1

REV. DEC. 1964
REV. NOV. 1964
MARCH 1964



ALL CAPACITORS IN uf
EXCEPT AS NOTED.
CR-101, CR-102 = 1N198
Q-102, Q-104 = 2N1374
Q-103 = 2N2102
* CR-102 MAY BE STRAPPED
IN SOME UNITS

FIG. 2



S-7
SENS SWITCH
10DB STEPS

DEC. 1964

FIG-2A

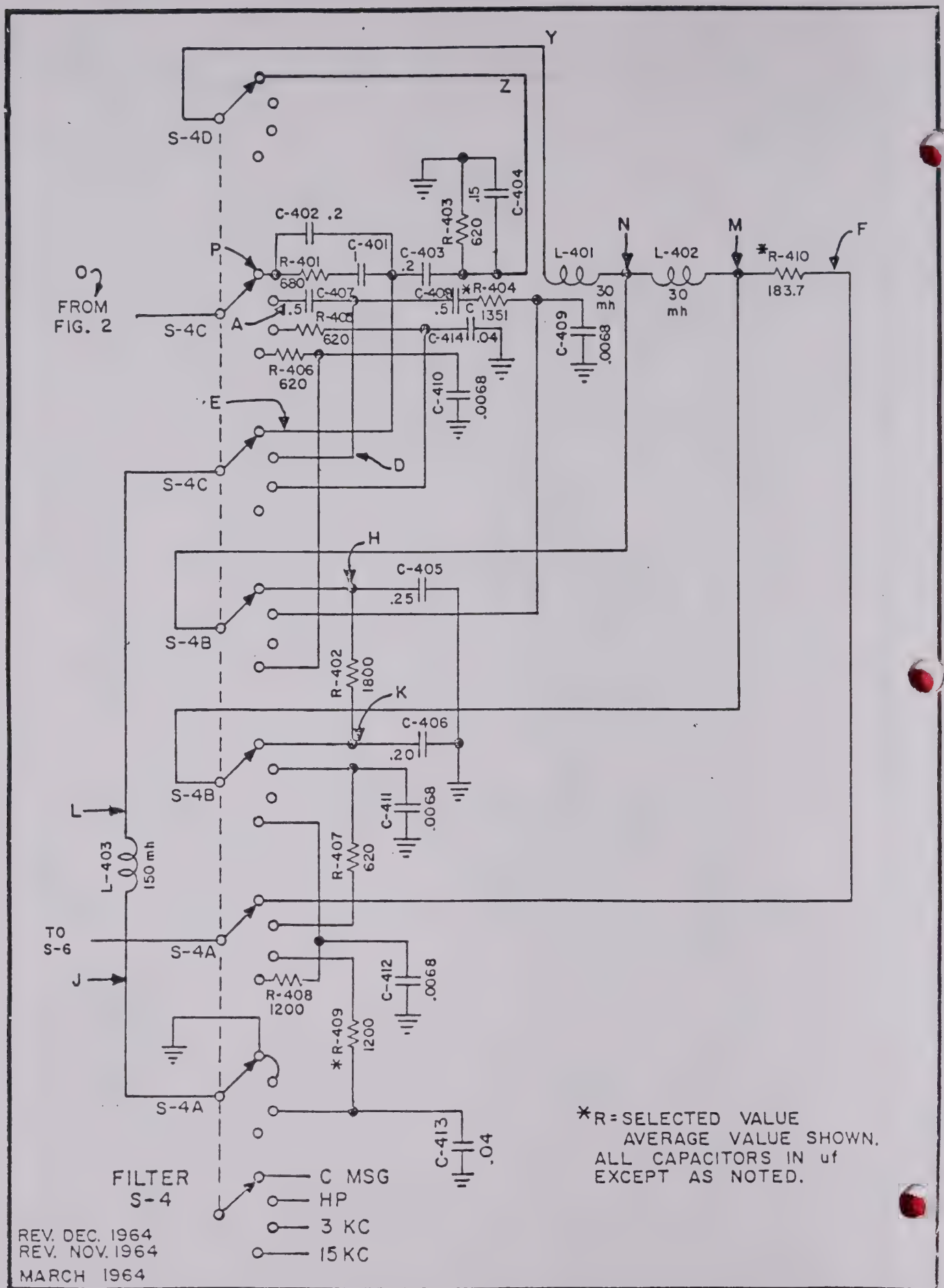
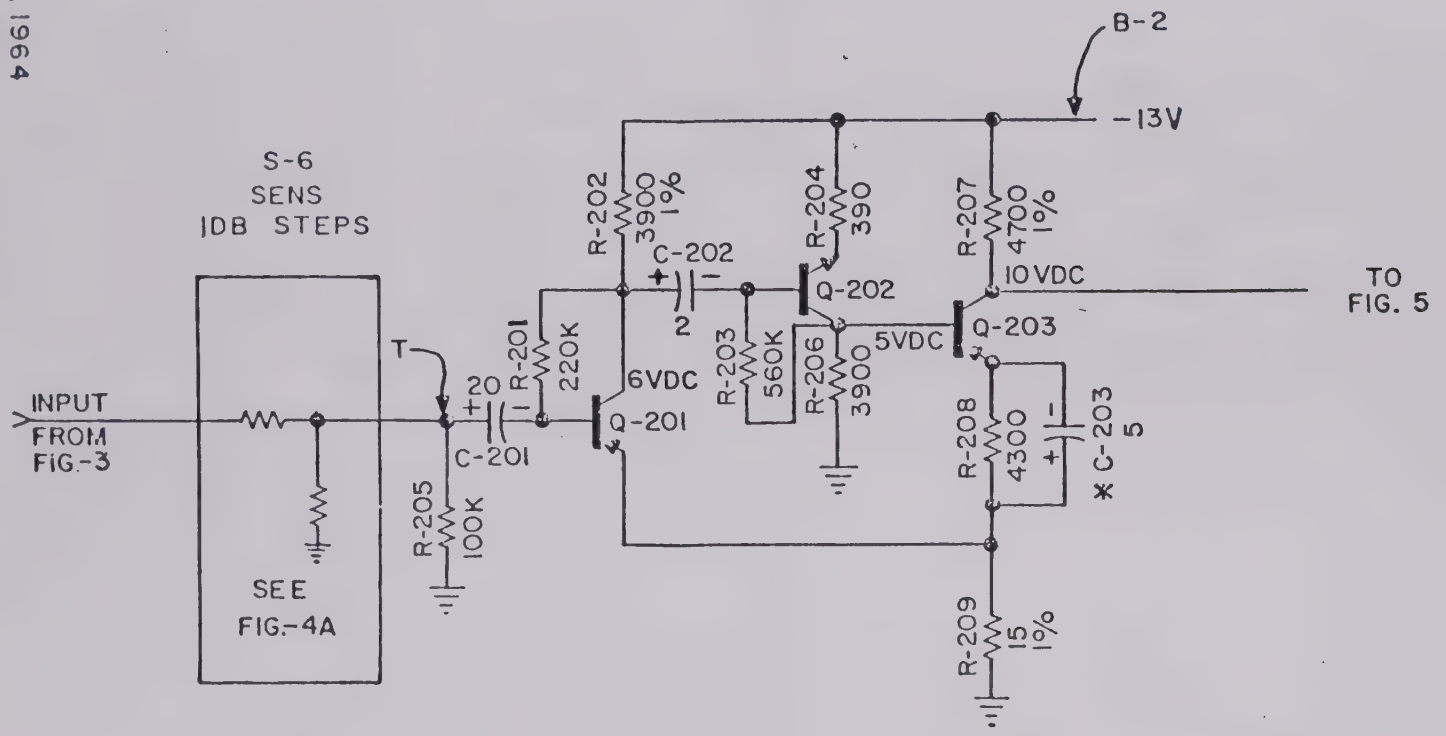

Y
Z
S-4D
C-402 .2
C-401
C-403 .2
R-403 620
.15 C-404
P
R-401 680
FROM FIG. 2
S-4C
A
C-407 .5
R-405 620
C-408 .5
*R-404 C 1351
C-414 .04
R-406 620
C-410 .0068
L-401 30 mh
N
L-402 30 mh
M
*R-410 183.7
F
C-409 .0068
E
D
S-4C
H
C-405 .25
S-4B
R-402 1800
K
C-406 .20
S-4B
C-411 .0068
L
L-403 150 mh
R-407 620
TO S-6
S-4A
J
R-408 1200
C-412 .0068
*R-409 1200
S-4A
C-413 .04
FILTER S-4
C MSG
HP
3 KC
15 KC
REV. DEC. 1964
REV. NOV. 1964
MARCH 1964
*R = SELECTED VALUE
AVERAGE VALUE SHOWN.
ALL CAPACITORS IN uf
EXCEPT AS NOTED.

FIG. 3

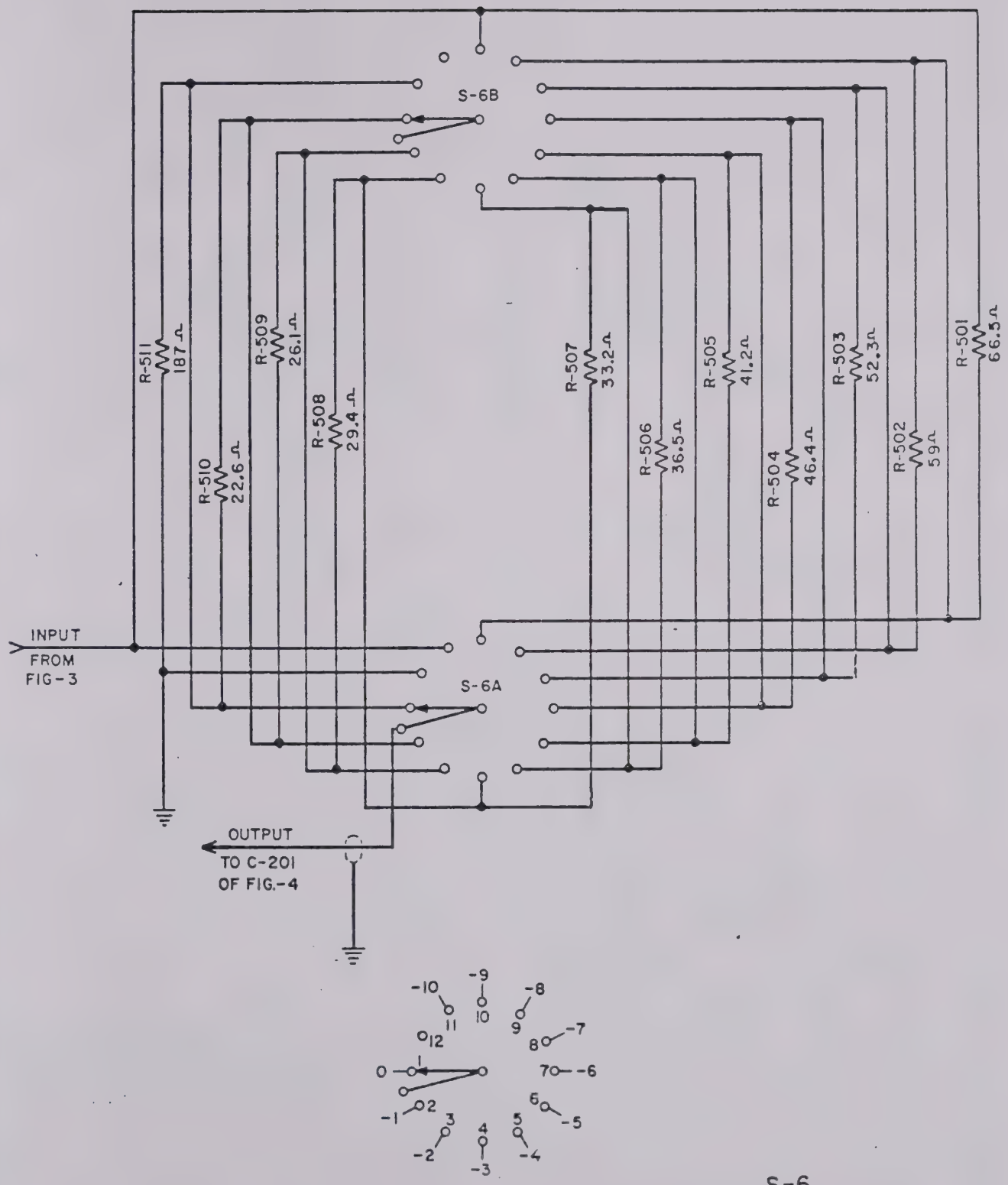
REV. DEC. 1964
REV. NOV. 1964
MARCH 1964



ALL CAPACITORS IN uf
EXCEPT AS NOTED
Q-201=2N1748A
Q-202=NS734
Q-203=2N1374

* SELECTED VALUE, AVERAGE VALUE SHOWN

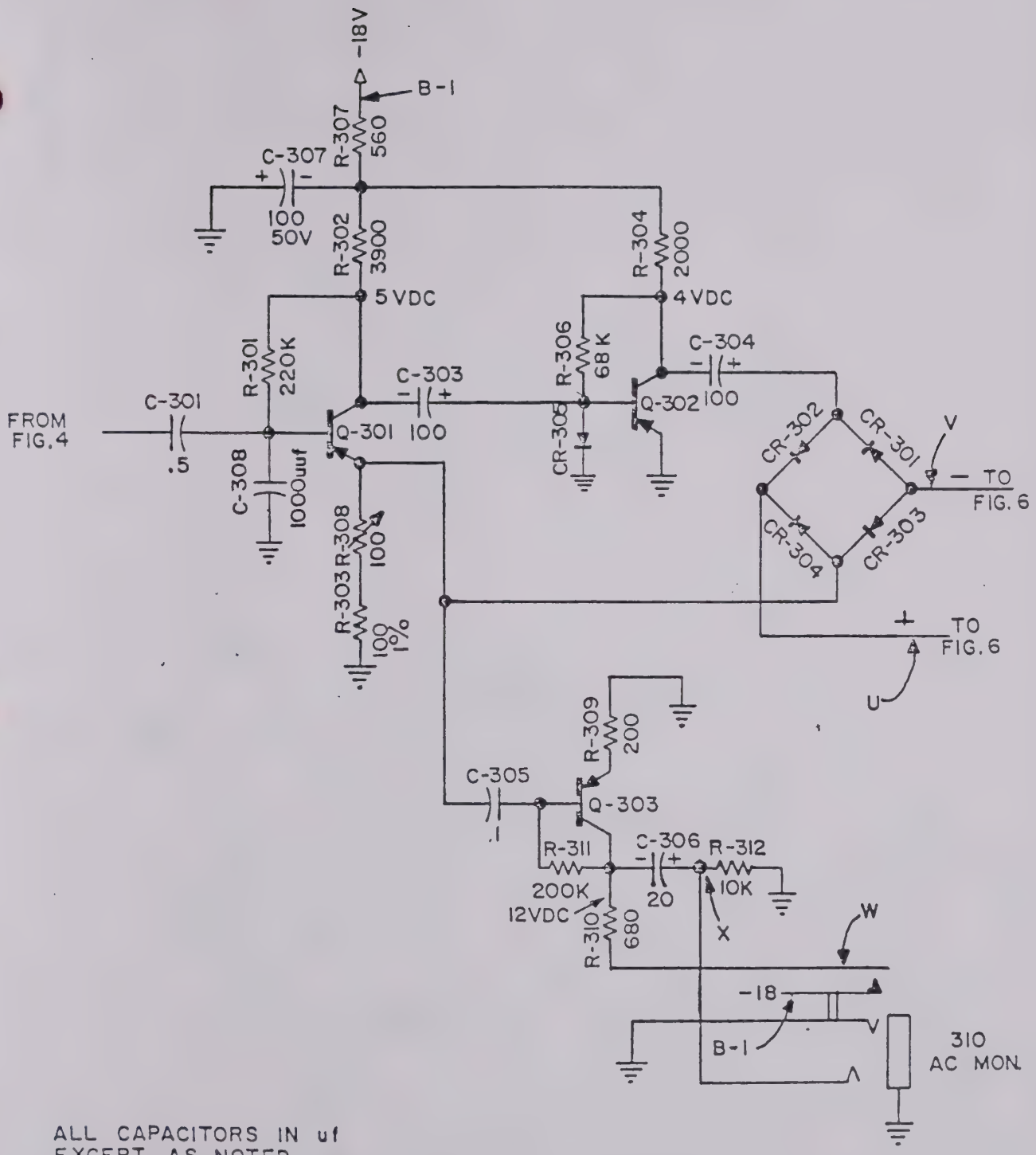
FIG. 4



S-6
SENS SWITCH
IDB STEPS

DEC. 1964

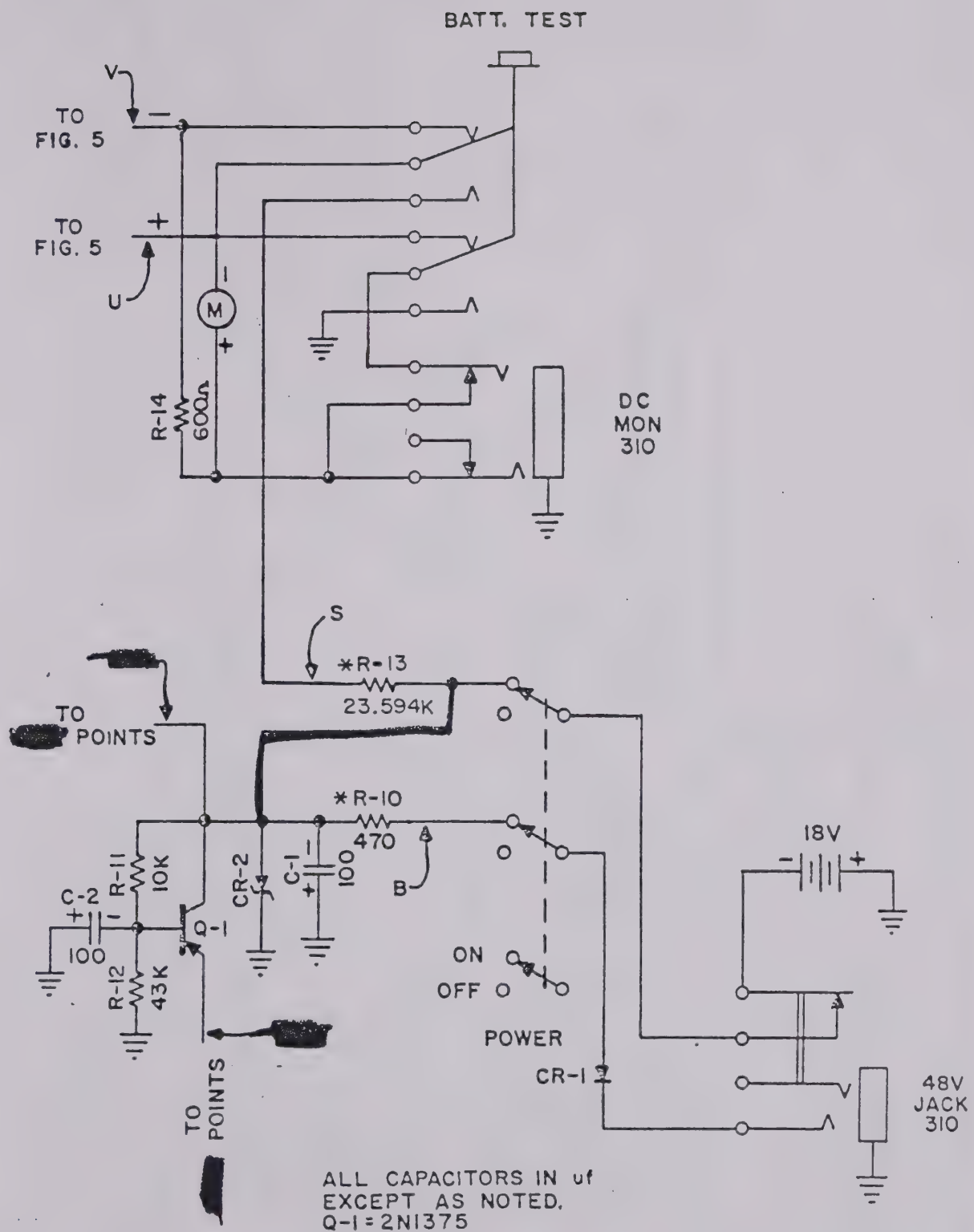
FIG.-4A



ALL CAPACITORS IN uf
EXCEPT AS NOTED.
Q-301, Q-302, Q-303 = 2N1374
CR-301 THRU CR-305 = IN198

REV. NOV. 1964
MARCH 1964

FIG 5

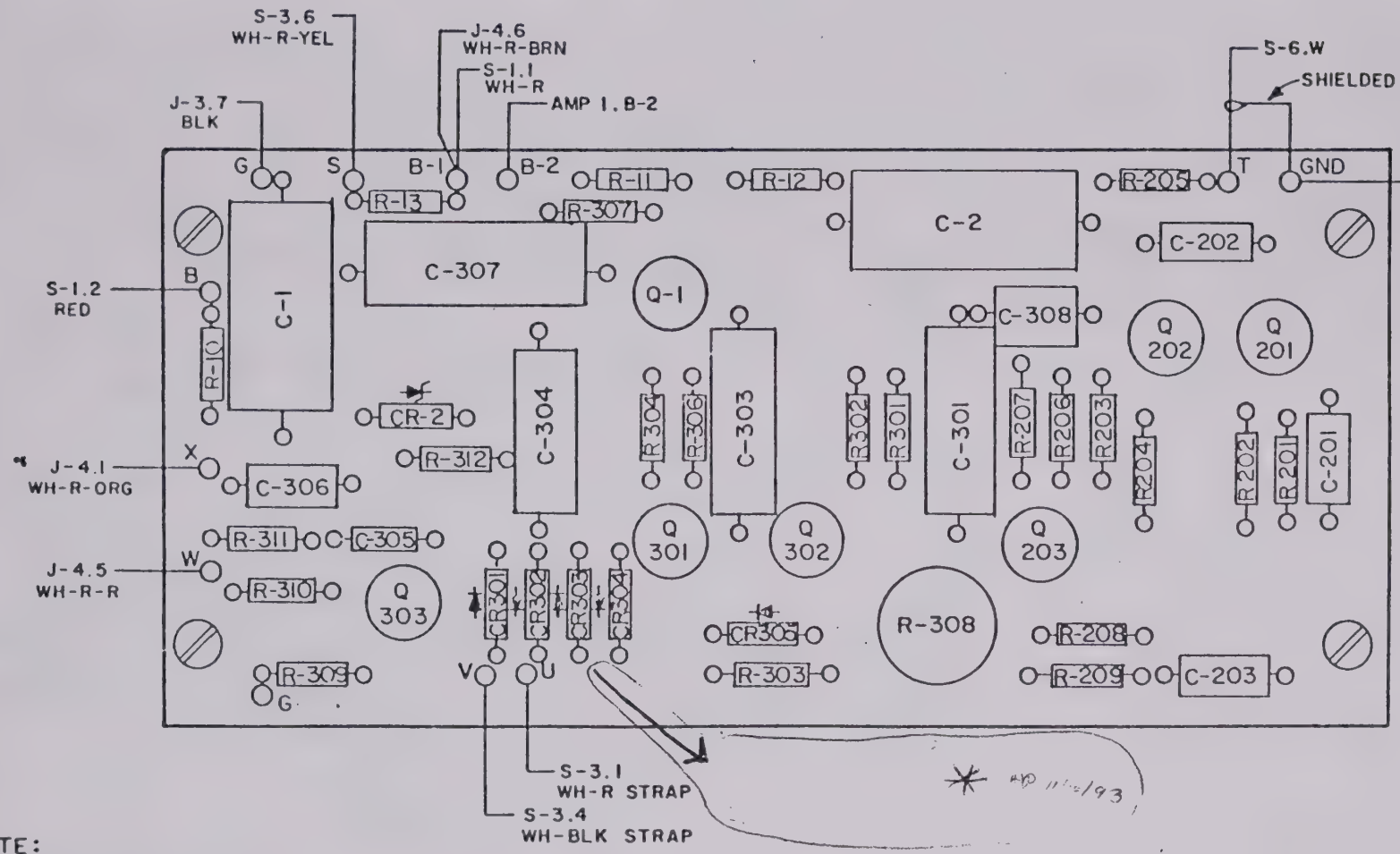


ALL CAPACITORS IN uf
EXCEPT AS NOTED.
Q-1 = 2N1375
CR-1 = IN2069
CR-2 = 1N3029B

* SELECTED VALUE, AVERAGE VALUE SHOWN

REV. NOV. 1964
MARCH 1964

FIG. 6



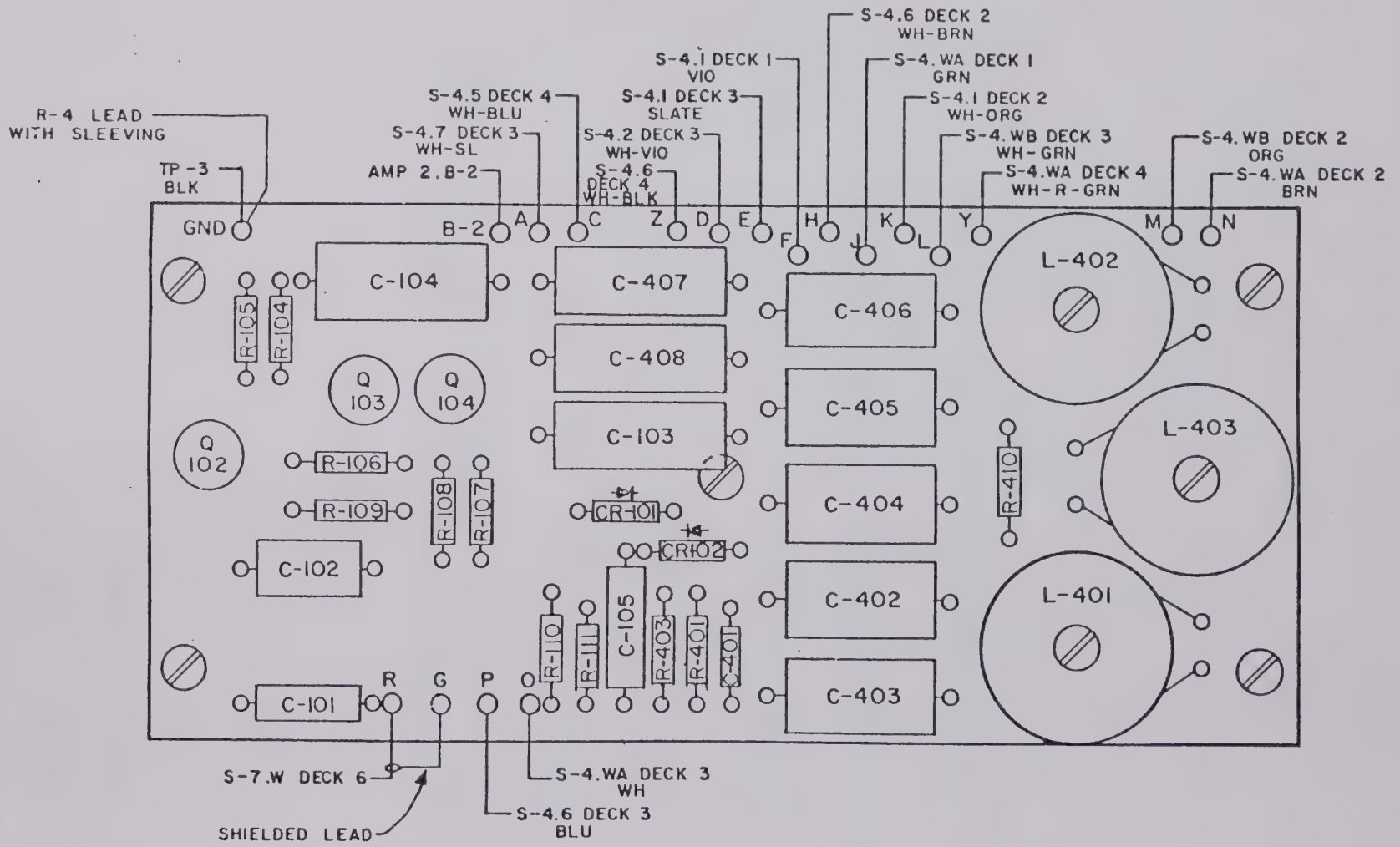
NOTE:
FOR TTS-38B DELETE R-13, LEADS GOING TO S-3.6, J-4.5 ADD A STRAP BETWEEN TERM. "B-1" AND "W."

TTS-37B/38B
AMP #2
COMPONENT LOCATION

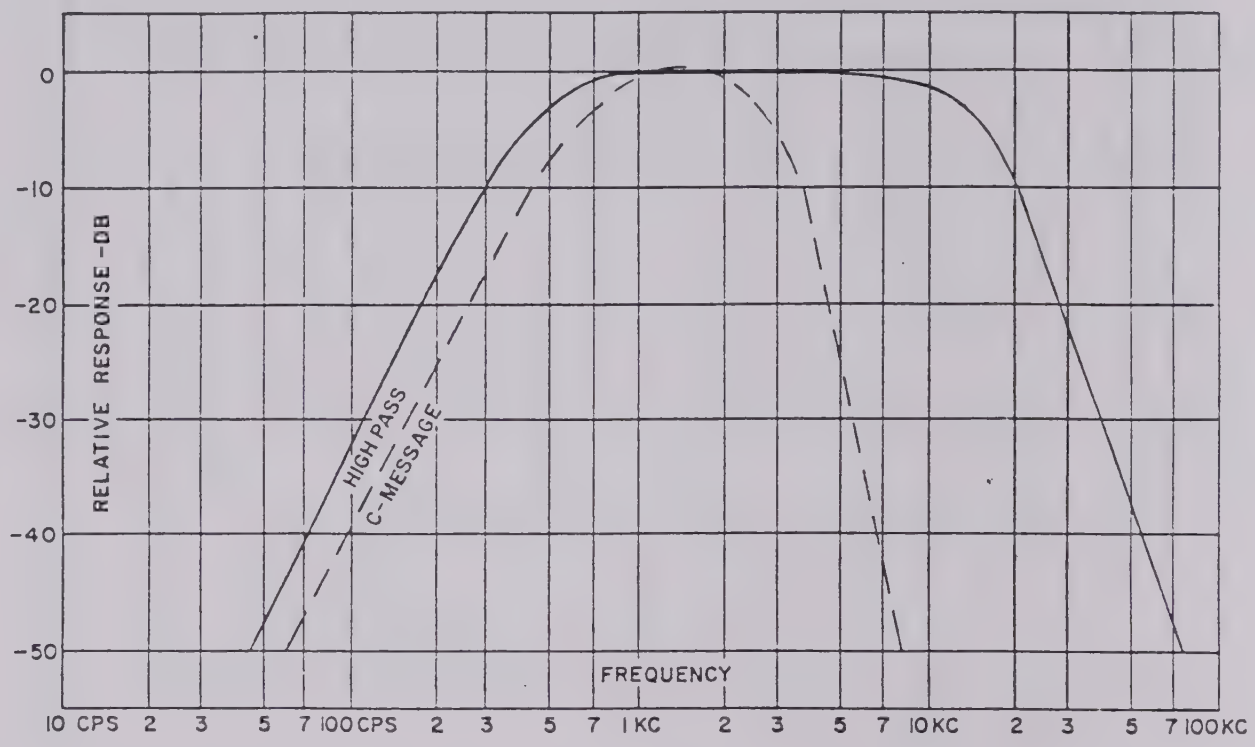
A-10674

FIG. 7

REV. DEC 1964
MARCH 1964



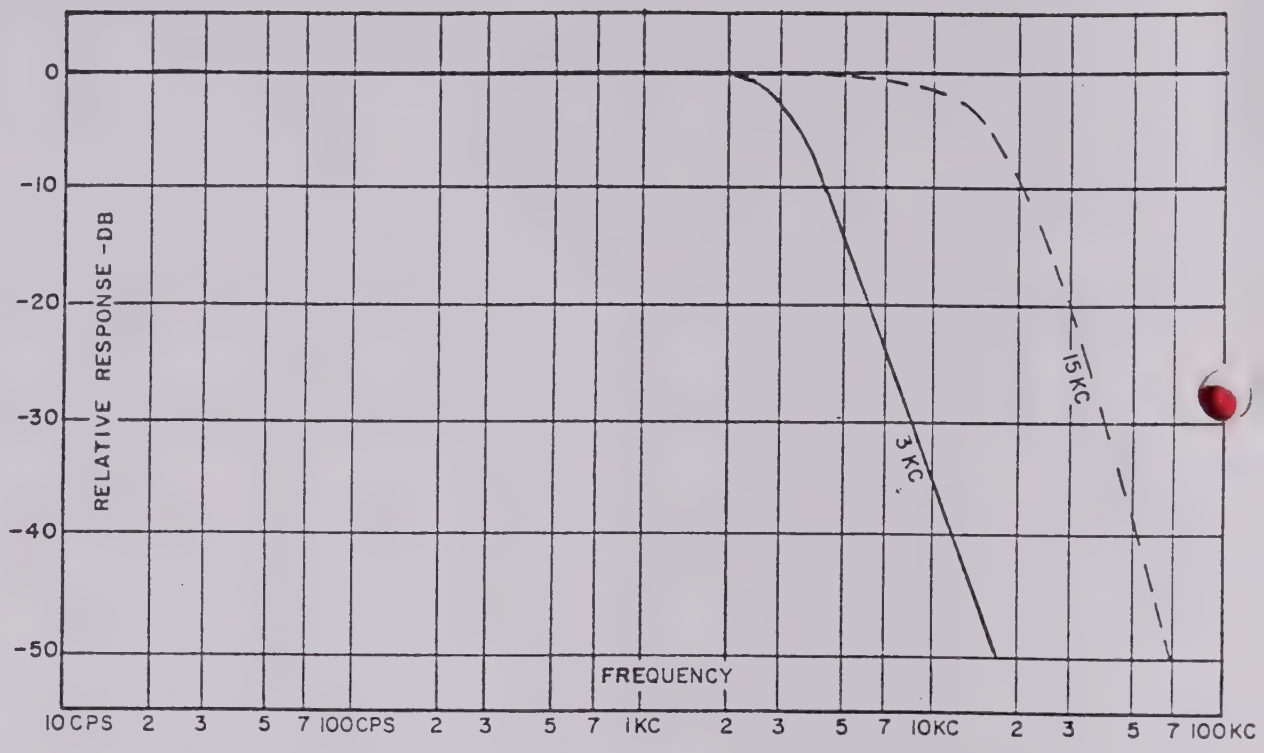
TTS-37B/38B
AMP #1
COMPONENT LOCATION



MODEL TTS-37B

FREQUENCY RESPONSE
WITH
C-MESSAGE AND HIGH PASS FILTERS

MARCH 1964



MODEL TTS-37B

FREQUENCY RESPONSE
WITH
3 KC and 15 KC FILTERS

MARCH 1964

MODEL TTS 37B MEASURING SET
TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	MFR* & MFR'S Designation
C1	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	H, APD-127
C2	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	H, APD-127
C3A	Capacitor: fixed, polarized, 100 mfd, 150 vdc	O, TVA-1420
C3B	Capacitor: fixed, polarized, 100 mfd, 150 vdc	O, TVA-1420
C101	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	H, APD-046
C102	Capacitor: fixed, mica, 560 mmfd, 400 vdc	C, CM20D561
C103	Capacitor: fixed, electrolytic, 100 mfd, 20 vdc	H, APD-095
C104	Capacitor: fixed, paper, 0.25 mfd, 20 vdc	O, 2PS-P25
C105	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	H, APD-046
C201	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	H, APD-046
C202	Capacitor: fixed, electrolytic, 2 mfd, 15 vdc	O, TE-1149
C203	Capacitor: fixed, electrolytic, 5 mfd, 15 vdc	O, TE-1152
C301	Capacitor: fixed, paper, 0.5 mfd, 200 vdc	A, P8292ZN12
C303	Capacitor: fixed, electrolytic, 100 mfd, 20 vdc	H, APD-095
C304	Capacitor: fixed, electrolytic, 100 mfd, 20 vdc	H, APD-095
C305	Capacitor: fixed, ceramic disc, 0.1 mfd, 75 vdc	E, DDA-104
C306	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	H, APD-046
C307	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	H, APD-127
C308	Capacitor: fixed, mica, 1000 mmfd, 400 vdc	C, CM19E102
C401	Capacitor: fixed, ceramic disc, 1 mfd, 25 vdc	O, 5C13
C402	Capacitor: fixed, paper, 0.20 mfd, 200 vdc	O, 2PS-P20
C403	Capacitor: fixed, paper, 0.20 mfd, 200 vdc	O, 2PS-P20
C404	Capacitor: fixed, paper, 0.15 mfd, 200 vdc	O, 2PS-P15
C405	Capacitor: fixed, paper, 0.25 mfd, 200 vdc	O, 2PS-P25
C406	Capacitor: fixed, paper, 0.20 mfd, 200 vdc	O, 2PS-P20
C407	Capacitor: fixed, paper, 0.5 mfd, 200 vdc	A, P8292ZN12

Circuit Ref.	Description	Mfr* & Mfr Designation
C408	Capacitor: fixed, paper, 0.5 mfd, 200 vdc	A, P8292ZN12
C409	Capacitor: fixed, paper, 0.0068 mfd, 600 vdc	O, 6PS-D68
C410	Capacitor: fixed, paper, 0.0068 mfd, 600 vdc	O, 6PS-D68
C411	Capacitor: fixed, paper, 0.0068 mfd, 600 vdc	O, 6PS-D68
C412	Capacitor: fixed, paper, 0.0068 mfd, 600 vdc	O, 6PS-D68
C413	Capacitor: fixed, paper, 0.04 mfd, 100 vdc	C, IDP-1-403
C414	Capacitor: fixed, paper, 0.04 mfd, 100 vdc	C, IDP-1-403
R1	Resistor: fixed, metal film, 42,200 ohm ±1%, ½ w	I, CEC-TO
R2	Resistor: fixed, metal film, 42,200 ohm ±1%, ½ w	I, CEC-TO
R3	Resistor: fixed, metal film, 475 ohm ±1%, ½ w	I, CEC-TO
R4	Resistor: fixed, metal film, 475 ohm ±1%, ½ w	I, CEC-TO
R5	Resistor: fixed, metal film, 316 ohm ±1%, ½ w	I, CEC-TO
R6	Resistor: fixed, metal film, 316 ohm ±1%, ½ w	I, CEC-TO
R7	Resistor: fixed, metal film, 1084.5 ohm ±1%, ½ w	I, CEC-TO
R8	Resistor: fixed, metal film, 4530 ohm ±1%, ½ w	I, CEC-TO
R9	Resistor: fixed, metal film, 84.5 K ±1%, ½ w	I, CEC-TO
R10	Resistor: fixed, wirewound, 470 ohm ±5%, 3 w	O, 242E4715
R11	Resistor: fixed, composition, 10 K ± 5%, ½ w	B, EB 1035
R12	Resistor: fixed, composition, 43 K ±5%, ½ w	B, EB 4335
R13	Resistor: fixed, composition, 23,594 K ±1%, ½ w	I, CEC-TO
R14	Resistor: fixed, copper wire, 600 ohm ±5%, 0.10 w	R, CR-16
R104	Resistor: fixed, composition, 820 K ±5%, ½ w	B, EB 8245
R105	Resistor: fixed, composition, 3.9 K ±5%, ½ w	B, EB 3925
R106	Resistor: fixed, metal film, 47 ohm ±1%, ½ w	I, CEC-TO
R107	Resistor: fixed, composition, 560 K ±5%, ½ w	B, EB 5645

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	Mfr* & Mfr's Designation
R108	Resistor: fixed, composition, 3.9 K ± 5%, ½ w	B, EB3925
R109	Resistor: fixed, metal film, 1.5 K ±1%, ½ w	I, CEC-TO
R110	Resistor: fixed, metal film, 560 ohm ±1%, ½ w	I, CEC-TO
R111	Resistor: fixed, composition, 10 K ±5%, ½ w	B, EB1045
R201	Resistor: fixed, composition, 220 K ±5%, ½ w	B, EB2245
R202	Resistor: fixed, metal film, 3.9 K ±1%, ½ w	I, CEC-TO
R203	Resistor: fixed, composition, 560 K ±5%, ½ w	B, EB5645
R204	Resistor: fixed, composition, 390 ohm ±5%, ½ w	B, EB3915
R205	Resistor: fixed, composition, 100 K ±10%, ½ w	B, EB1051
R206	Resistor: fixed, composition, 3.9 K ±5%, ½ w	B, EB3925
R207	Resistor: fixed, metal film, 4.7 K ±1%, ½ w	I, CEC-TO
R208	Resistor: fixed, composition, 4.3 K ±5%, ½ w	B, EB4325
R209	Resistor: fixed, metal film, 15 ohm ±1%, ½ w	I, CEC-TO
R301	Resistor: fixed, composition, 220 K ±5%, ½ w	B, EB2245
R302	Resistor: fixed, composition, 3.9 K ± 5%, ½ w	B, EB3925
R303	Resistor: fixed, metal film, 100 ohm ±1% ½ w	I, CEC-TO
R304	Resistor: fixed, composition, 2 K ±5%, ½ w	B, EB2025
R306	Resistor: fixed, composition, 68 K ±5%, ½ w	B, EB6835
R307	Resistor: fixed, composition,560 ohm ±5%, ½ w	B, EB5615
R308	Resistor: variable, wirewound, 100 ohm 2 ½	K, 39-100
R309	Resistor: fixed, composition, 200 ohm ±5%, ½ w	B, EB2015
R310	Resistor: fixed, composition, 680 ohm ±5%, ½ w	B, EB6815
R311	Resistor: fixed, composition, 200 K ±5%, ½ w	B, EB2045
312	Resistor: fixed, composition, 10 K ±5%, ½ w	B, EB1035
R401	Resistor: fixed, metal film, 680 ohm ±1%, ½ w	I, CEC-TO

Circuit Ref.	Description	Mfr* & Mfr' Designation
R402	Resistor: fixed, metal film, 1800 ohm ±1%, ½ w	I, CEC-TO
R403	Resistor: fixed, metal film, 620 ohm ±1%, ½ w	I, CEC-TO
R404	Resistor: fixed, metal film, 1351 ohm ±1%, ½ w	I, CEC-TO
R405	Resistor: fixed, metal film, 620 ohm ±1%, ½ w	I, CEC-TO
R406	Resistor: fixed, metal film, 620 ohm ±1%, ½ w	I, CEC-TO
R407	Resistor: fixed, metal film, 620 ohm ±1%, ½ w	I, CEC-TO
R408	Resistor: fixed, metal film 1200 ohm ±1%, ½ w	I, CEC-TO
R409	Resistor: fixed, metal film, 1200 ohm ±1%, ½ w	I, CEC-TO
R410	Resistor: fixed, metal film, 183.7 ohm ±1%, ½ w	I, CEC-TO
R501	Resistor: fixed, metal film, 66.5 ohm ±1%, ½ w	I, CEC-TO
R502	Resistor: fixed, metal film, 59.0 ohm ±1%, ½ w	I, CEC-TO
R503	Resistor: fixed, metal film, 52.3 ohm ±1%, ½ w	I, CEC-TO
R504	Resistor: fixed, metal film, 46.4 ohm ±1%, ½ w	I, CEC-TO
R505	Resistor: fixed, metal film, 41.2 ohm ±1%, ½ w	I, CEC-TO
R506	Resistor: fixed, metal film, 36.5 ohm ±1%, ½ w	I, CEC-TO
R507	Resistor: fixed, metal film, 33.2 ohm ±1%, ½ w	I, CEC-TO
R508	Resistor: fixed, metal film, 29.4 ohm ±1%, ½ w	I, CEC-TO
R509	Resistor: fixed, metal film, 26.1 ohm ±1%, ½ w	I, CEC-TO
R510	Resistor: fixed, metal film, 22.6 ohm ±1%, ½ w	I, CEC-TO
R511	Resistor: fixed, metal film, 187 ohm ±1%, ½ w	I, CEC-TO
R601	Resistor: fixed, metal film, 1370 ohm ±1%, ½ w	I, CEC-TO
R602	Resistor: fixed, metal film, 4320 ohm ±1%, ½ w	I, CEC-TO
R603	Resistor: fixed, metal film, 13,700 ohm ±1%, ½ w	I, CEC-TO
R604	Resistor: fixed, metal film, 634 ohm ±1%, ½ w	I, CEC-TO
R605	Resistor: fixed, metal film, 19,600 ohm ±1%, ½ w	I, CEC-TO

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	Mfr* & Mfr's Designation
R606	Resistor: fixed, metal film, 19,600 ohm ±1%, ½ w	I, CEC-TO
R607	Resistor: fixed, metal film, 665 ohm ±1%, ½ w	I, CEC-TO
R608	Resistor: fixed, metal film, 665 ohm ±1%, ½ w	I, CEC-TO
J1	Jack: telephone (LINE)	P, M444B
J2	Jack: telephone (DIAL)	P, M444B
J3	Jack: telephone (48V)	P, M446A
J4	Jack: telephone (AC MON)	P, M446A
J5	Jack: telephone (1 MA MON)	P, M444B
L1	Inductor	D, 2740J
L401	Inductor: 30 mh	T, EC-030
L402	Inductor: 30 mh	T, EC-030
L403	Inductor: 150 mh	T, ET-150
M	Meter: special, 0-1 ma	NEC, 458
S1	Switch: toggle DPDT (POWER)	M, 513
S2	Switch: toggle SPST (HOLD)	M510
S3	Switch: pushbutton, DPDT (BATT TEST)	P, NF-4006
S4	Switch: rotary, 5 position, 8 pole (FILTER)	E, PA-1026
S5	Switch: rotary, 11 position, 5 pole (INPUT)	E, PA-1016
S6	Switch: rotary, 11 position, 2 pole (1 DB ATTEN)	E, PA-2004
S7	Switch: rotary, 11 position, 6 pole (10 DB ATTEN)	E, PA-1022
T1	Transformer	U, A20
Q1	Transistor: PNP	S, 2N-1375
Q102	Transistor: PNP	S, 2N-1374
Q103	Transistor: NPN	V, NS-734
Q104	Transistor: PNP	S, 2N-1374

Circuit Ref.	Description	Mfr* & Mfr's Designation
Q201	Transistor: PNP	O, 2N-1748A
Q202	Transistor: NPN	V, NS-734
Q203	Transistor: PNP	S, 2N-1374
Q301	Transistor: PNP	S, 2N-1374
Q302	Transistor: PNP	S, 2N-1374
Q303	Transistor: PNP	S, 2N-1374
CR1	Diode Rectifier	Q, 1N2069
CR2	Zener Regulator: 24V, ±5%	L, 1N3029B
CR101	Diode Rectifier	Q, 1N198
CR102	Diode Rectifier	Q, 1N198
CR301	Diode Rectifier	Q, 1N198
CR302	Diode Rectifier	Q, 1N198
CR303	Diode Rectifier	Q, 1N198
CR304	Diode Rectifier	Q, 1N198
CR305	Diode Rectifier	Q, 1N198
	Knobs: for S4, S5, S6, S7	J, S648-3LBB
	Binding Post: red (2 per set)	G, 29-1R
	Binding Post	M, #137SP
	Battery: 9-volt (2 per set)	F, 2356

*See List of Manufacturers Code Letters for Replaceable Parts Table on next page.

INSTRUCTION MANUAL

MODEL

TTS 37B

NOISE - LEVEL - VU MEASURING SET

SERIAL 4401 AND ABOVE

ISSUE 2

AUG. 1972

NORTHEAST ELECTRONICS CORPORATION

P.O. BOX 649 - CONCORD, N. H. 03301

AREA CODE 603 224-7466

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6	ELECTRONIC PARTS LIST	6-1
7	SCHEMATIC DIAGRAM	7-1

SECTION 1

DESCRIPTION

1.1 GENERAL. The Model TTS 37B is a compact, transistorized set designed to measure a wide range of transmission levels, VU, and noise. It has a sensitivity range of -95 dBm and -5 dBrn. Switchable filters are provided internally to either attenuate the low frequency band around 60 Hz and its harmonics, or to attenuate frequencies above the voice band. A filter which provides C-Msg weighting is also included. Provisions for dialing out on a line are available, as is a hold coil for holding the circuit.

1.2 Two monitor jacks are provided. The first provides a DC output which may be used to drive a 1 mA recorder. The second jack provides an AC output which may be used to drive an impulse noise measuring set, a telephone headset to determine the nature of the signal, or to drive external circuits, thereby using the Model 37B as a variable, high gain amplifier.

1.3 The sensitivity of the set can be varied from -80 dBm to +20 dBm in 1 dB and 10 dB steps by means of two attenuators; these attenuators are also calibrated in dBrn from 0 to 100 dBrn in blue numbers for easy identification. Circuits of either 600 or 900Ω, balanced or unbalanced, can be measured in either a terminated or bridging condition.

1.4 Noise to ground can be measured with a 40 dB loss; a longitudinal drain is supplied. A BATT TEST pushbutton switch is provided which measures the condition of the internal batteries and determines if 48V is properly connected. A diode is provided to protect the internal circuits against damage in the event the wrong polarity of 48V is inadvertently applied.

1.5 The set is equipped with two 9-volt batteries which provide approximately 230 hours of life. It can also be operated from 48V station battery.

NOTE

This instrument provides approximate VU measurements, The meter balistics have not been accurately calibrated to provide precise readings.

SECTION 2

SPECIFICATIONS

2.1 METER. A $4\frac{1}{2}$" meter with several scales is provided as follows:

a. Scale tracking accuracy (+3 to -3 dB on meter): ±0.15 dB maximum error.

b. VU-dB scale calibrated in black divisions and numbers from +3 to -15 dB. Between +1 dB and -1 dB, the scale is calibrated in 0.1 dB divisions; 0.2 dB between +1 and +3 and -1 and -3 dB; 0.5 dB divisions are used between -3 and -10 dB; 1 dB divisions are used between -10 and -15 dB.

c. The dBrn scale markings are the same as dB scale with blue numbers from +13 to -5 dBrn.

d. A VU quality scale is marked in three colors: Green between 0 and +3 dB; yellow between -6 and 0 dB; red between -15 and -6 dB.

e. A BATT TEST scale with a green arc to indicate GOOD.

2.2 RANGE OF MEASUREMENTS

a. Level Measurements: +23 dBm to -95 dBm.

b. Noise Measurements: 113 dBrn to -5 dBrn.

c. Noise to Ground Measurements: 113 dBrn to -5 dBrn.

2.3 INPUT IMPEDANCES - Balanced input transformer.

a. Terminated: 600 or 900Ω ±5% with phase angle of less than 5° when hold coil is out.

b. Bridging: 12,000Ω on 600Ω circuit
15,000Ω on 900Ω circuit

c. Longitudinal Drain: Across the line - 85,000Ω
To Ground - 100,000Ω.

2.4 FREQUENCY RESPONSE. The frequency response for designated positions of the FILTER switch, normalized to 1 kHz at room temperature, is as follows. (See Figs. 2-1 and 2-2).

C MSG: -3 dB from 625 to 710 Hz and 2800 to 3100 Hz
-40 dB from 85 to 115 Hz and 6000 to 7000 Hz

HIGH PASS: Not less than 45 dB rejection at 60 Hz
-3 dB from 13 kHz to 16 kHz with 18 dB/octave slope at higher frequencies.

3 kHz: ±0.25 from 100 to 1000 Hz
-3 dB from 2.8 kHz to 3.2 kHz with 18 dB/octave slope at higher frequencies.

15 kHz: ±0.25 dB from 100 to 5000 Hz
-3 dB from 13 kHz to 15 kHz with 18/dB octave slope at higher frequencies.

2.5 ATTENUATOR ACCURACY: (Reference to 0 dBm setting): ±0.15 dB from +10 dB to -60 dB. ±0.3 dB from +20 dB to -70 dB.

2.6 HOLD CIRCUIT. A low resistance hold coil can be switched in or out. At frequencies below 200 Hz, this coil will have an effect on the response characteristic and will therefore effect the accuracy of measurements.

2.7 AC MONITOR OUTPUT

a. Output Impedance: 600Ω

b. Output Level: approx. -10 dBm when meter reads 0 dB

2.8 DC MONITOR OUTPUT

a. The DC output is approx. 0.7 mA when meter reads 0 dBm.

b. The DC resistance of the external measuring circuit, such as a recorder,

should not exceed 300Ω and must be isolated from ground.

2.9 STABILITY OF CALIBRATION

a. Stability with Temperature (with respect to readings at 25°C):

±0.1 dB from 20°C to 30°C
±0.3 dB from 0°C to 50°C

b. Stability with Battery Voltage within green BATT TEST arc on meter:
0.05 dB change

2.10 POWER REQUIREMENTS

a. Battery operation: requires two 9-volt Eveready 2356 batteries or equivalent. Current drain approximately 11 mA (without AC monitor).

b. Battery life: Intermittent use: approximately 230 hours; continuous use: approximately 210 hours

c. 48V operation: requires 48V office battery. Disconnects internal battery when 48V jack is utilized. Current drain approximately 35 mA.

2.11 SIZE: 8" x 11" x 10"

2.12 WEIGHT: 14 lb.

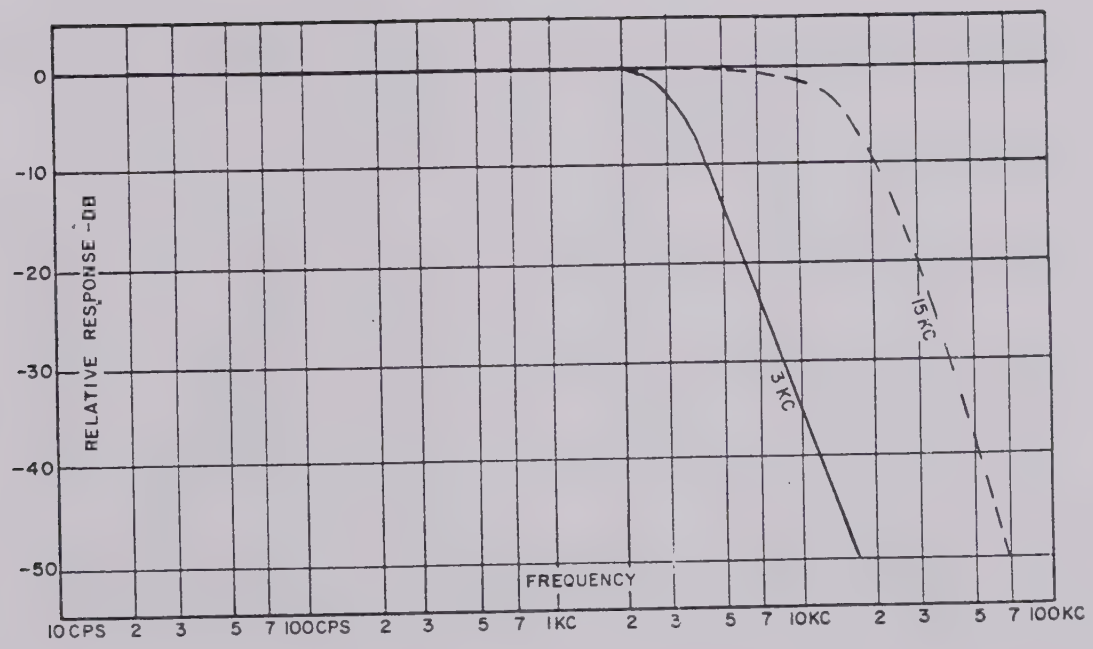


Figure 2-1 Frequency Response with 3KC and 15KC Filters

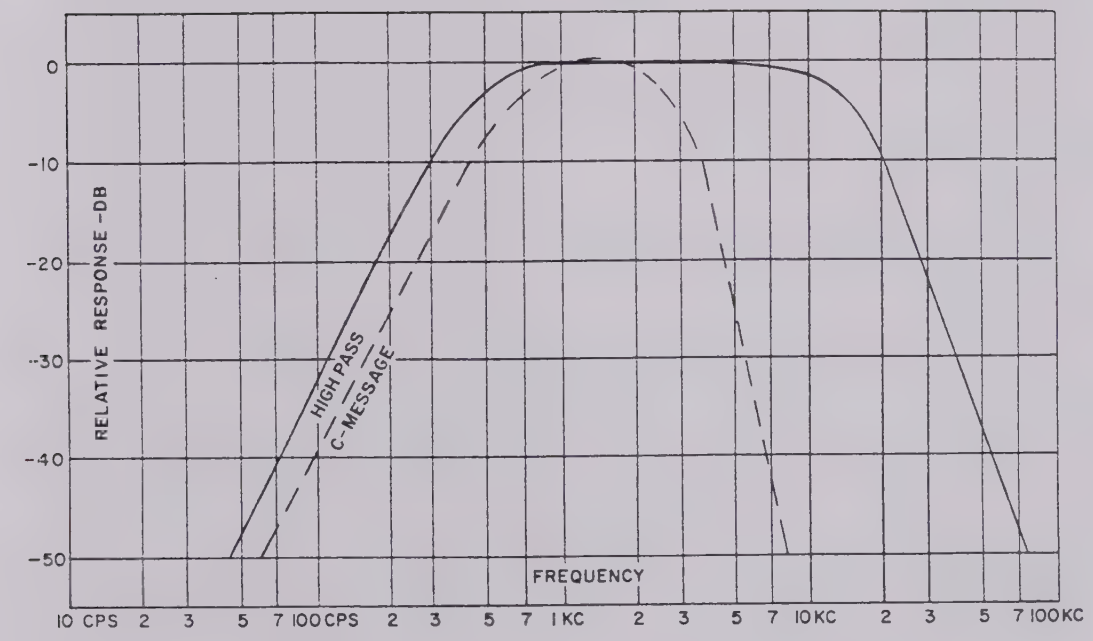


Figure 2-2 Frequency Response with C-Message and High Pass Filters

SECTION 3

OPERATING INSTRUCTIONS

3.1 FRONT PANEL CONTROLS. Table 3-1 and Fig. 3-1 describe and locate the front panel controls on the TTS 37B.

Ref Desig.	Name of Control	Type of Control	Use or Purpose
1	POWER	Toggle switch	Connects the internal battery to the circuits.
2	48V	Telephone jack	Provided to allow connection of central office battery to set.
3	BATT TEST	Pushbutton switch	Connects the meter to the battery test circuit which indicates the condition of the batteries.
4	HOLD	Toggle switch	When switch is ON, a hold coil is connected across the line jack and terminals.
5	MON (AC)	Telephone jack	Provided to allow connection of a telephone headset to monitor the tone being measured.
6	MON (DC)	Telephone jack	Provided to allow connection of an external DC monitor (recorder or meter) device in series with the meter.
7	FILTER	Rotary switch	Selects desired filter to be presented to the signal being measured.
8	SENS (1 dB/step) SENS (10 dB/step)	Rotary switches	To adjust the amount of gain necessary in the set to obtain a meter reading. Greatest accuracy is obtained when the upper portion of the meter is used.
9	INPUT	Rotary switch	To select the function of the input circuits.

Ref Desig.	Name of Control	Type of Control	Use or Purpose
10	LINE	Binding posts	Provided to allow connection to the input when using a GR type connector.
11	LINE	Telephone jack	Provided to allow connection to the input when using a telephone plug.
12	GND	Binding post	Provided to allow connection to the chassis of the set.
13	DIAL	Telephone jack	Provided to allow connection of a dial or subscriber set with a dial to the LINE jack when the INPUT switch is in the DIAL & TALK position.

3.2 OPERATING INSTRUCTIONS.

3.3 LEVEL MEASUREMENTS

a. Open lid (may be detached by moving to right).

b. Turn POWER ON.

c. Depress BATT TEST pushbutton switch and note if meter needle falls in green arc marked GOOD. Replace batteries with Eveready 2356 or equivalent if step 3 indicates bad.

d. Set INPUT switch to desired impedance.

e. Set FILTER switch to 15 KC.

f. Connect circuit to be tested to either the LINE jack or LINE binding posts.

g. Set SENS attenuator switches to obtain a convenient reading on meter. A more accurate measurement may be obtained if the meter needle falls between the black numerals +3 and -3 dBm.

h. The level is the algebraic sum of the SENS switches reading (BLACK NUMBERS ONLY) and the meter reading (BLACK NUMBERS ONLY). Likewise, the SENS switches readings are the algebraic sum of the black numerals.

EXAMPLE:

SENS Switches	Meter Reading	Level
+7 BLACK	+2 BLACK	+9
+15 BLACK	-3 BLACK	+12
0 BLACK	-1.6 BLACK	-1.6
-10 BLACK	+2.4 BLACK	-7.6
-15 BLACK	-0.6 BLACK	-15.6

i. To monitor the tone being measured, insert a 310 plug connected to a telephone headset in the AC MON jack. (This output jack can be connected to a 600Ω impedance receiving device with little effect on meter reading.)

3.4 NOISE MEASUREMENTS

a. Follow steps a through f under 3.3.

b. Set SENS switches to 85 (blue numbers).

c. Connect circuit to be tested to either LINE jack or LINE binding posts.

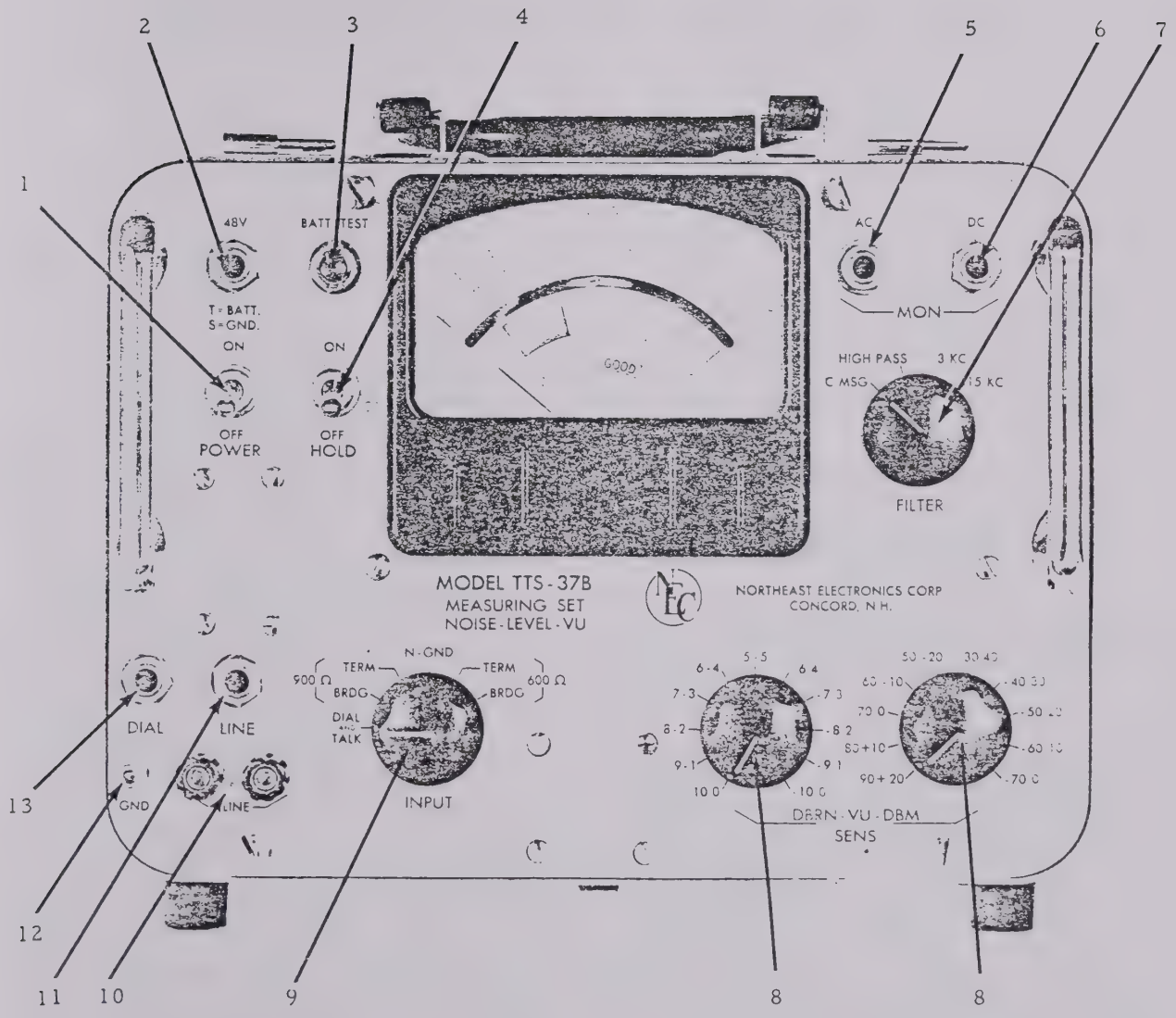


Fig. 3-1 Front Panel Controls

d. Reset SENS switches to obtain a convenient reading on meter preferably between 7 dBrn and 13 dBrn (blue numbers only).

e. The noise reading is then the algebraic sum of SENS switches reading (BLUE NUMBERS ONLY), and the meter reading (BLUE NUMBERS ONLY).

EXAMPLE:

SENS Switches	Meter Reading	Noise Level
27 BLUE	7 BLUE	34 dBrn
35 BLUE	10 BLUE	45 dBrn
22 BLUE	12 BLUE	34 dBrn

f. To monitor the noise being measured, insert a 310 plug connected to a telephone headset in AC MON jack. This output jack can be connected to a 600Ω impedance device with little effect on meter reading.

NOTE 1: When recording noise measurements, the type of filter should be indicated such as 42 dBrn - C Msg or 85 dBrn 15 KC flat.

NOTE 2: To make "noise to ground" measurements, set input switch to N-GND and connect a good ground to the GND binding posts.

3.5 VU MEASUREMENTS

a. Follow steps a through g under 3.3, Level Measurement.

b. Set SENS switches to BLACK numbers to obtain reference point.

c. Meter needle deflections into green (0 dB to +3 dB) and yellow (-6 to 0 dB) or red (-15 to -6 dB), arcs may now be noted.

3.6 TO TALK

a. Set INPUT switch to DIAL & TALK.

b. Connect telephone headset to DIAL jack.

c. Connection now establishes to circuit connected to LINE jack.

NOTE: Circuit under test must supply DC talk battery.

3.7 TO DIAL

a. Set INPUT switch to DIAL & TALK.

b. Connect dial or subscriber's set with dial to the DIAL jack.

c. A number may now be dialed on circuit connected to LINE jack.

3.8 TO HOLD AND RELEASE

a. Operate HOLD key to ON to hold a circuit, OFF to release.

NOTE 1: The HOLD circuit, when ON, will hold a circuit connected to LINE jack when INPUT switch is in any position.

NOTE 2: The HOLD coil may be influenced by strong magnetic fields. This normally occurs in more sensitive positions. Relocation of the set away from the field, orientation within the field, or operation on HIGH PASS or C MSG will reduce the effect.

3.9 TO OPERATE ON 48 Volts

a. Insert cord equipped with 310 plug in 48V jack; the tip must be connected to battery and sleeve to ground.

b. Connect other end to a 48 volt supply.

c. Operate POWER switch to ON.

d. Depress BATT TEST key and observe correct polarity and voltage by meter needle swinging to the green arc (GOOD).

e. To disconnect the 48 volts, first remove the connection of 48 volts from cord, then remove 310 plug from 48V jack.

3.10 TO DC MONITOR OR RECORD

a. Follow normal procedure under 3.3 and 3.4.

CAUTION: The external DC monitor (recorder for meter) device must have a relatively low resistance (not over 300Ω) and must be isolated from ground.

b. Connect monitoring device to DC MON jack (tip and ring). If monitoring devices resistance is correct, there will be no change in reading on 37B meter.

c. Calibrate external monitor. (odB meter reading will produce approximately 0.7 mA.

3.11 STORAGE. Always attach lid to test set when not in use. This automatically turns POWER switch OFF when closed.

SECTION 4

CIRCUIT DESCRIPTION

4.1 CIRCUIT DESCRIPTION (See Fig. 7-1) The gain of the set is obtained from three amplifiers. Each amplifier is enclosed with a large amount of negative feedback to ensure gain stability. The inherent noise level of the set is at least -100 dBm and approaches -120 dBm when the C message filter is used. The unit can be divided into the following basic circuits.

a. Input circuit
b. 10 dB step attenuator
c. Amplifier 1
d. Filter switching network
e. 1 dB step attenuator
f. Amplifier 2
g. Amplifier 3
h. Metering circuit
i. Monitoring circuits
j. Power section

4.2 INPUT CIRCUIT. The input line connections are made to a balanced transformer with dc blocking capable of withstanding 150 V dc of either polarity. Terminating resistors for 600 and 900 ohm input impedances can be switched directly across the input line and the dc blocking is still maintained. These resistors and the hold coil, which can be switched across the line, are switched at the equal potential or center-tapped position to maintain balance. The input circuit is balanced at least 80 dB at 60Hz, 70 dB at 1000 Hz and better than 60 dB up to 10 kHz. A longitudinal drain, whose center tap is connected to ground through a resistor, is supplied.

4.3 The transformer has a 1:1 ratio. Since the secondary of this is loaded by a high impedance, the primary of the transformer also looks like a high impedance. This reflected impedance is seen in the bridging positions of the INPUT switch. It is nominally 12,000Ω for 600Ω circuits and 15,000Ω for 900Ω circuits; the bridging losses will be less than 0.2 dB for frequencies down to approximately 100 Hz.

4.4 10 dB STEP ATTENUATOR. This attenuator, which is the main sensitivity adjustment of the set, provides 0 to 90 dB of attenuation in 10 dB steps. Five "L" pads having losses of 10, 20, 30, 40 and 50 dB are inserted to provide the 0 to 50 dB of attenuation in 10 dB steps. The 60, 70, 80, 90 dB steps are the result of combining the 50 dB pad with the 10, 20, 30, 40 dB pads respectively.

4.5 AMPLIFIER 1. This amplifier is a 3-stage amplifier having a voltage gain of approximately 30 dB. The input impedance is approximately 20,000Ω and output impedance is built-up to approximately 600Ω with a series resistance to match the input impedances of the filters.

4.6 FILTER SWITCHING NETWORK. Selects the proper filter network to produce the response shown in Figs. 2-1 and 2-2. The insertion loss is approximately 12 dB. The overall gain of the unit is calibrated with the 15 KC filter switched in. This position has no provision for loss adjustment. Once the overall gain has been set, the remaining filters are alternately selected and with the potentiometers provided, the loss of these filter positions are normalized with that of the 15 KC position.

4.7 1 dB STEP ATTENUATOR. This is a conventional stepped voltage divider which presents a 600Ω impedance to the filter and is terminated by the high impedances of Amplifier 2. One-half percent ($\frac{1}{2}$%) resistors are used to assure an accuracy better than ±0.15 dB.

4.8 AMPLIFIER 2. This circuit is a 3-stage amplifier having a voltage gain of approximately 50 dB. Since the input impedance is greater than 30,000Ω, any change in output impedance of the 1 dB step attenuator, when changing attenuator steps will be negligent. Attenuator output impedance change is approximately 600 to 200Ω.

4.9 AMPLIFIER 3. This circuit is a 2-stage amplifier which drives a complementary pair of transistors that rectify the sinusoidal signal similar to that of a diode bridge. The use of transistors rather than diodes provides current gain, allowing greater dynamic range. The meter movement, requiring dc current, is driven alternately on each half cycle from the complementary pair of transistors. The

rectified half cycles of current are re-combined through capacitors to form a sinusoidal Signal from which negative feedback to the first stage is provided. This configuration having the rectifying elements and meter enclosed within the negative feedback loop provides greater circuit stability when subject to temperature change and provides linear output, meter reading vs input voltage.

4.10 METERING CIRCUIT. The terminals of the meter are wired through the BATT TEST pushbutton switch so that when depressed, the meter is removed from the amplifier detector circuit and connected between the internal battery and ground through a dropping resistor which converts the milliammeter into a voltmeter to monitor the condition of the battery.

4.11 MONITORING CIRCUITS. The DC MON jack provides a means to connect an external milliammeter or recorder in series with the meter of the set. The characteristics of Amplifier 3, with the bridge incorporated in the feedback loop, produce a high impedance or constant source for the meter. Thus, the external meter can have a wide range of resistance. It is advisable, to ensure maximum accuracy of reading. to keep this resistance of the external meter recorder below 300Ω. It is also necessary to keep the external meter or recorder isolated from ground electrically since part of the feedback would be shorted out. Whenever the meter reads 0 dBm, the available current is approximately 0.7mA.

4.12 The AC MON circuit consists of Q211, which samples part of the signal available in Amplifier 3, amplifies it, and provides a given source of impedance available to the AC MON jack. The signal which this amplifier samples is at the emitter of Q207 in Amplifier 3. This is a sine wave, and is still a direct function of the signal appearing at the line jacks. The input impedance of the monitor amplifier Q211 is high enough so that it does not shunt the emitter resistance of Q207 and therefore it does not materially influence the amount of feedback or the value of the gain of either Amplifier 3 or the entire set. To conserve internal battery power, the collector supply of Q211 is normally cut off until the plug is inserted into the AC MON jack. The signal available at the AC MON jack is dc blocked so that a dc resistance can be inserted between the tip and ground of the jack. This dc blocking is done by a 20μF 25V electrolytic capacitor which means that if any dc voltage should be applied to the tip of the AC MON jack, it should not exceed 9V negative which would reverse bias the capacitor, or 12volt positive which would exceed the voltage rating of the capacitor.

4.15 POWER SECTION. The set operates from two sources of power: 18 volt internal battery and 48 volt CO battery. When operating from the internal battery, the 18 volts is dropped to approximately 12 volts by a zener diode regulator circuit. This regulated supply serves all circuits in the set. When operating from the CO battery, the internal battery becomes disconnected from the 12V regulator and 48 volts is applied to a 24 volt zener diode regulator circuit. This regulated 24 volts is now connected to the input of the 12 volt regulator circuit.

SECTION 5

MAINTENANCE AND CALIBRATION

5.1 BATTERY REPLACEMENT. To replace batteries, perform the following steps;

a. Remove set from the case by loosening the four captive screws on the front panel.

b. Disconnect the red and black wires from the batteries.

c. Remove the battery retaining plate.

d. Remove old batteries and replace with new ones.

e. Connect the red and black wires to the batteries and replace battery retaining plate.

f. Turn POWER switch on and check batteries by depressing BATT TEST pushbutton - Meter should indicate in green arc.

g. If batteries check OK, replace set in case and tighten the four captive screws.

5.2 MAINTENANCE. In the event of an inaccurate or missing meter indication, the following checks should be made:

a. Check batteries. When the BATT TEST pushbutton is depressed the meter should indicate in the green arc, if not, the batteries should be replaced. (Refer to paragraph 5.1).

b. Check for correct control settings as follows:

FUNCTION switch - set in desired function.

SENS - to be of sufficient sensitivity to give a reading.

INPUT - Connected signal to proper jack or pair of terminals. (preferably 1kHz)

DC MON - If used, plug must have low dc resistance.

FILTER - set to desired position.

c. If all controls are set correctly and batteries check OK and the meter indication is still incorrect, the internal circuits can be checked.

5.3 INPUT CIRCUIT CHECK. Remove set from case and proceed as follows:

a. Place SENS switch in -70 dB position.

b. Place INPUT switch in either 600 TERM or 600 BRDG position.

c. Place POWER switch in OFF position.

d. Connect a 1000 Hz, 0 dBm signal (NEC TTS 43A or equivalent) to the LINE jack.

e. With a VTVM or an oscilloscope, check for approximately 2 volts peak to peak at pin 7 of transformer T1. The same signal should also appear at the wiper of deck 2A of switch S5 (INPUT) and the wiper of deck 1 of switch S4 (SENS). This signal should also appear at the base of transistor Q201 (pin 24 of printed circuit board).

5.4 AMPLIFIER #1 CHECK. (Q201, Q202, and Q203).

a. Turn POWER switch to ON

b. Set -10 dB/step attenuator to -40 dBm.

c. Connect an oscilloscope to pin 23 of the printed circuit board. (output of amplifier #1). The level at this point should be approximately 1.5V peak to peak. If there is no output or it is very low, proceed to the next step.

d. Remove signal from INPUT terminals; measure the dc voltages at the collector of Q201 and Q202 and at the emitter of Q203. (Refer to schematic diagram 6-1.)

CAUTION: When checking dc voltages, use a VTVM (20,000Ω per volt) on the 10V scale.

5.5 FILTER CHECK

a. Connect 1000 Hz 0 dB signal to the INPUT terminals and set the 10 dB/step attenuator to -40 dBm and the 1 dBm/step attenuator to -10 dBm.

b. Connect an oscilloscope to pin 9 on the printed circuit board. The signal here should be approximately 0.3 V peak to peak.

5.6 AMPLIFIER #2 CHECK. If previous steps are correct, proceed as follows:

a. Place both SENS switches in the 0 dBm position.

b. With an oscilloscope check the level at the collector of transistor Q206. This should be approximately 0.4V peak to peak.

c. If this voltage is not correct, check the dc voltages in the same manner as in paragraph 5.4d observing the CAUTION.

5.7 AMPLIFIER #3 CHECK.

a. This amplifier is checked in the same way as is amplifier #2. The level at the collector of Q208 should be approximately 2V peak to peak. and should appear flattened.

b. When checking the dc voltages in this circuit, observe the CAUTION under paragraph 4.3d.

5.8 CALIBRATION. If calibration of the set is required, perform the following:

a. Set front panel controls:

INPUT	TERM 600Ω
HOLD	OFF
POWER	ON
SENS	Both controls at 0 dBm
FILTER	15 KC

b. Connect a 0 dBm, 1000 Hz signal to the LINE jack and adjust R234 for 0 dBm on the front panel meter.

c. Repeat for the 3 KC position of the FILTER switch and adjust R217 for 0 dBm on the meter.

d. Repeat for the HIGH PASS position of the FILTER switch and adjust R215 for 0 dBm on the meter.

e. Repeat for the C MSG position of the FILTER switch and adjust R213 for 0 dBm on the meter.

SECTION 6

ELECTRONIC PARTS LIST

6.1 INTRODUCTION. The following pages contain the parts list for the Model TTS 37B.

6.2 FSCM CODE NUMBERS. The Federal Supply Code of Manufacturers of each part. A list of manufacturers and their respective code numbers is given below.

Code No.	Manufacturer
01121	Allen Bradley
04009	Arrow-Hart & Hegeman
05397	Kemet
05844	Callins
06819	NEC
07716	IRC
09653	IEI
06555	Beede Electrical Instrument Co.
12065	Transitron
13606	Sprague
15873	Motorola
17[illegible]	Fairchild
17[illegible]	Electronic Moulding Corp.
22650	Whale Electronics
71590	Centralab
76854	Oak Manufacturing Co.
72136	Electro Motive Mfg. Co., (Elmenco)
80223	UTC
81095	Triad
82389	Switchcraft
83330	H. H. Smith
84171	Arco

Ref Desig.	Description	Manufacturer (FSCM Code #)	Part Number
R101 and R106	R: 42.2K ±1% 1/8W	07716	CEA
R102	R: 84.5K ±1% 1/8W	07716	CEA
R103	R: 1.07K ±1% 1/8W	07716	CEA
R104	R: 4.53K ±1% 1/8W	07716	CEA
R105 and R108	R: 475Ω ±1% 1/8W	07716	CEA
R107 and R109	R: 316Ω ±1% 1/8W	07716	CEA
C101	C: 100μF 150V	22650	34-875-100-150-8NA

E-14-037-20-006

Q201	Transistor	15873	2N3905
Q202	Transistor	15873	2N3903
Q203	Transistor	15873	2N3905
Q204	Transistor	15873	2N3905
Q205	Transistor	15873	2N3903
Q206	Transistor	15873	2N3905
Q207	Transistor	15873	2N3905
Q208	Transistor	15873	2N3905
Q209	Transistor	15873	2N3903
Q210	Transistor	15873	2N3905
Q211	Transistor	15873	2N3905
Q212	Transistor	17803	2N4356
CR201	Diode	12065	1N4148
CR202	Diode	12065	1N2069
CR203	Diode 24V zener	12065	1N3029B
CR204	Diode 13V zener	15873	1N964B
CR205	Diode	12065	1N4148
R201	R: 820K ±10% ½W	01121	RC20
R202	R: 120K ±10% ½W	01121	RC20
R203	R: 47Ω ±1% 1/8W	07716	CEA
R204	R: 3.9K ±5% ½W	01121	RC20
R205	R: 100Ω ±10% ½W	01121	RC20
R206	R: 10K ±10% ½W	01121	RC20
R207	R: 1.5K ±1% 1/8W	07716	CEA
R208	R: 562Ω ±1% ½W	07716	CEA
R209	R: 680Ω ±5% ½W	01121	RC20
R210	R: 620Ω 5% ½W	01121	RC20
R211	R: 1.8K ±5% ½W	01121	RC20
R212	R: 56Ω ±5% ½W	01121	RC20
R213	Pot: 200Ω	07716	UPE-200RE-1
R214	R: 910Ω ±5% ½W	01121	RC20
R215	R: 500Ω pot	07716	UPE-200RE-1
R216	R: 620Ω ±5% ½W	01121	RC20

E-14-037-20-006 (cont.)

Ref Desig.	Description	Manufacturer (FSCM Code #)	Part Number
R217	Pot: 500Ω	07716	UPE-200RE-1
R218	R: 910Ω ±5% ½W	01121	RC20
R219	R: 620Ω ±5% ½W	01121	RC20
R220	R: 1.2K ±10% ½W	01121	RC20
R221	R: 620Ω ±5% ½W	01121	RC20
R222	R: 100K ±10% ½W	01121	RC20
R223	R: 220K ±10% ½W	01121	RC20
R224	R: 3.9K ±5% ½W	01121	RC20
R225	R: 15Ω ±1% 1/8W	07716	CEA
R226	R: 390Ω ±10% ½W	01121	RC20
R227	R: 560K ±10% ½W	01121	RC20
R228	R: 3.9K ±5% ½W	01121	RC20
R229	R: 4.64K ±1% 1/8W	07716	CEA
R230	R: 4.3K ±5% ½W	01121	RC20
R231	R: 220K ±10% ½W	01121	RC20
R232	R: 3.9K ±5% ½W	01121	RC20
R233	R: 143Ω ±1% 1/8W	07716	CEA
R234	Pot: 100Ω	07716	UPE-200RE-1
R235	R: 178Ω ±1% 1/8W	07716	CEA
R236	R: 150K ±5% ½W	01121	RC20
R237	R: 20K ±5%, ½W	01121	RC20
R238	R: 390Ω ±10% ½W	01121	RC20
R239	R: 390Ω ±10% ½W	01121	RC20
R240	R: 200K ±5% ½W	01121	RC20
R241	R: 680Ω ±5% ½W	01121	RC20
R242	R: 200Ω ±5% ½W	01121	RC20
R243	R: 10K ±10% ½W	01121	RC20
R244	R: 27K ±5% ½W	01121	RC20
R245	R: 680Ω ±5% ½W	01121	RC20
R246	R: 10K ±10% ½W	01121	RC20
R247	R: 560K ±10% ½W	01121	RC20
R248	R: 20K ±5% ½W	01121	RC20
R249	R: 470Ω ±10% ½W	01121	RC20
R250	R: 100Ω ±10% ½W	01121	RC20
R251	R: 100Ω ±10% ½W	01121	RC20
C201	C: 22μF 6V	05397	K22W6K
C202	C: 510pf 1K	71590	DD-511
C203	C: 0.22μF 50K	05397	KR22W50K
C204	C: 100μF 20V	09653	APD-095
C205	C: 0.01μF 100V	13606	225P
C206	C: 20μF 25V	09653	APD-046
C207	C: 1.0μF	13606	5C13
C208	C: 0.2μF 75V	13606	225P
C209	C: 0.2μF 75V	13606	225P
C210	C: 0.15μF 75V	13606	225P
C211	C: 0.27μF 75V	72136	IMD-3-274
C212	C: 0.22μF 75V	72136	IMD-3-224
C213	C:0.33μF 75V	13606	225P
C214	C: 0.27μF 75V	13606	225P
C215	C: 0.04μF 100V	84171	IDP-1-403
C216	C: 0.04μF 100V	84171	IDP-1-403
C217	C: 0.0068μF 100V	13606	225P

Ref. Desig.	Description	Mfr. Code (FSCM Code No.)	Part Number
C218	C: 0.0068μF 100V	13606	225P
C219	C: 20μF 25V	09653	APD-046
C220	C: 2.2μF 35V	05397	K2R2W35K
C221	C: 0.15μF 75V	13606	225P
C222	C: 4.7μF 25V	05297	K4R7W25K
C223	C: 0.1μF 50V	05397	KR1W50K
C224	C: 100μF 20V	05844	APD-095
C225	C: 0.0047μF 100V	13606	225P
C226	C: 10μF 10V	05397	K10W10K
C227	C: 10μF 10V	05397	K10W10K
C228	C: 0.1μF 75V	71590	DDA-104
C229	C: 20μF 25V	09653	APD-046
C230	C: 0.1μF 100V	05844	APD-127
C231	C: 100μF 50V	05844	APD-127
C232	C: 100μF 20V	05844	APD-095
C233	C: 20μF 25V	09653	APD-046
C234	C: 0.33μF 75V	13606	225P
L201	Ind: 30MH coils	81095	EC-030
L202	Ind: 30MH coils	81095	EC-030
L203	Ind: 150MH coils	81095	EC-150
L204	Ind: 150MH coils	81095	EC-150
L205	Ind: 30MH coils	81095.	EC-030

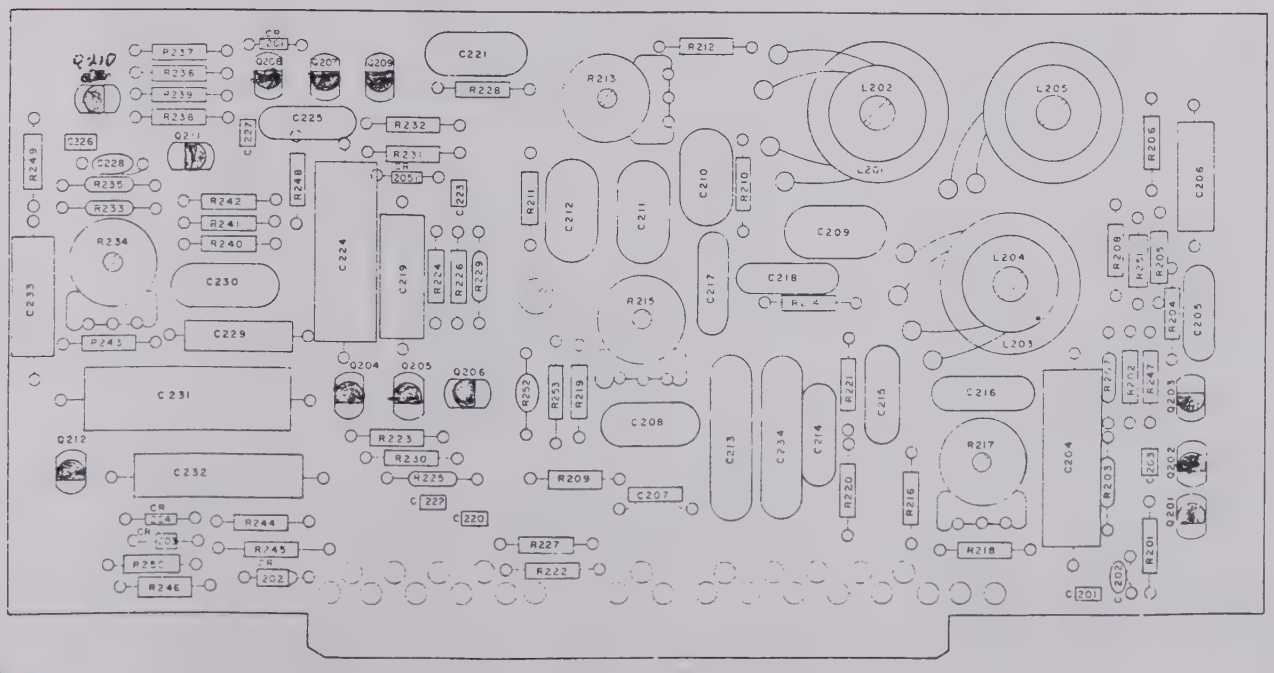


Fig. 6-1 Component Location E-14-037-20-006

Ref Desig.	Description	Manufacturer (FSCM Code #)	Part Number
S7	Switch: rotary	76854	269425-F4
R1, R10, R11	R: 20K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R2	R: 63.4Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R3	R: 205Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R4 and R14	R: 13.7K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R5	R: 649Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R6	R: 46.4K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R7	R: 2K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R8	R: 196K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R9	R: 6.34K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R12	R: 19.6 K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R13	R: 17.8K $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
S6	S: rotary	76854	269428
R15	R: 22.6Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R16	R: 26.1Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R17	R: 29.4Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R18	R: 33.2Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R19	R: 36.5Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R20	R: 41.2Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R21	R: 46.4Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R22	R: 52.3Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R23	R: 59Ω $\pm\frac{1}{2}\%$ 1/8 W	07716	CEA
R24	R: 66.5Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
R25	R: 191Ω $\pm\frac{1}{2}\%$ 1/8W	07716	CEA
T1	Transformer	80223	A-20 or GR-815
L1	Hold coil	06819	TN 1274
S1	S: toggle DPDT	04009	81027CB
S2	S: toggle SPDT	04009	81015K
S3	S: pushbutton	82389	NF-4006
S4	S: rotary	76854	269431-F2
S5	S: pushbutton	76854	272837K3
J1, J2, J5	Jacks: telephone	82389	M444B
J3, J4	Jacks: telephone	82389	M446A
J6, J7	Binding posts (LINE)	EMC*	5595-175-2
TP-1	Binding posts (GND)	83330	137SP
	Meter	06555	7685

SECTION 7

SCHEMATIC DIAGRAM

7.1 INTRODUCTION. This section contains the schematic diagrams for the Models TTS 37B, TTS 37B-1, TTS 37B-3 and TTS 37B-15.

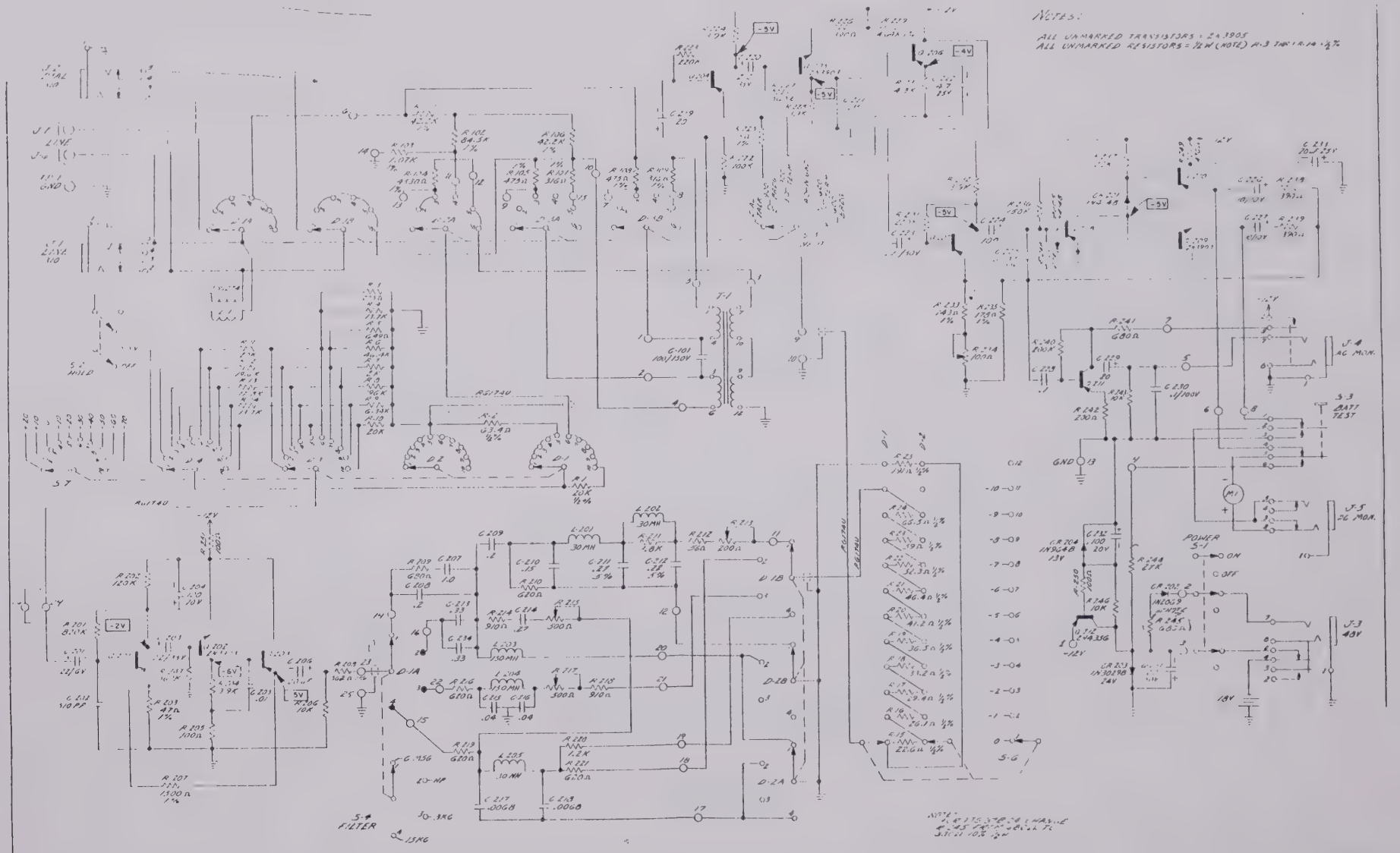


Figure 7-1. TTS 37B Schematic Diagram

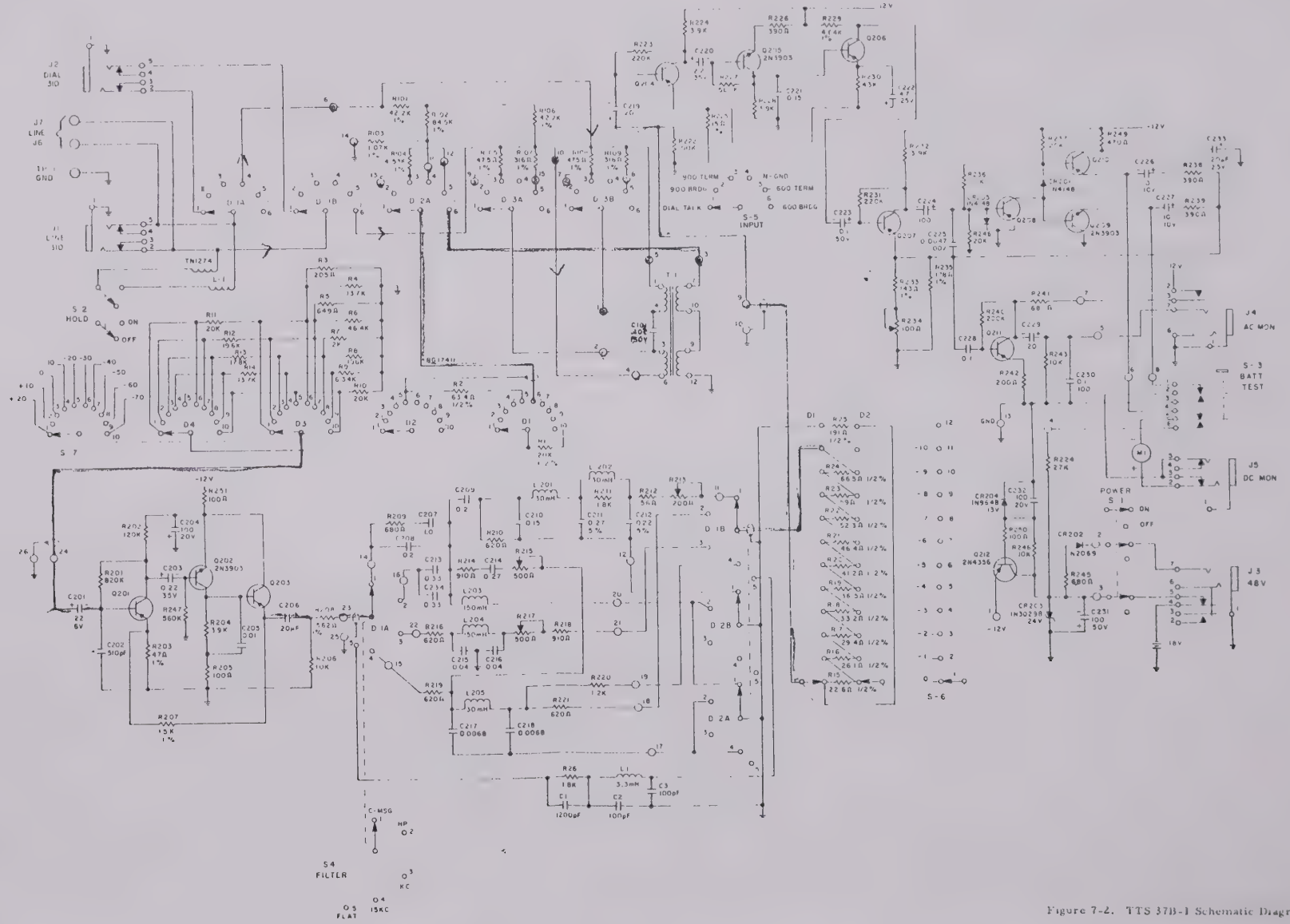


Figure 7-2. TTS 37B-1 Schematic Diagram

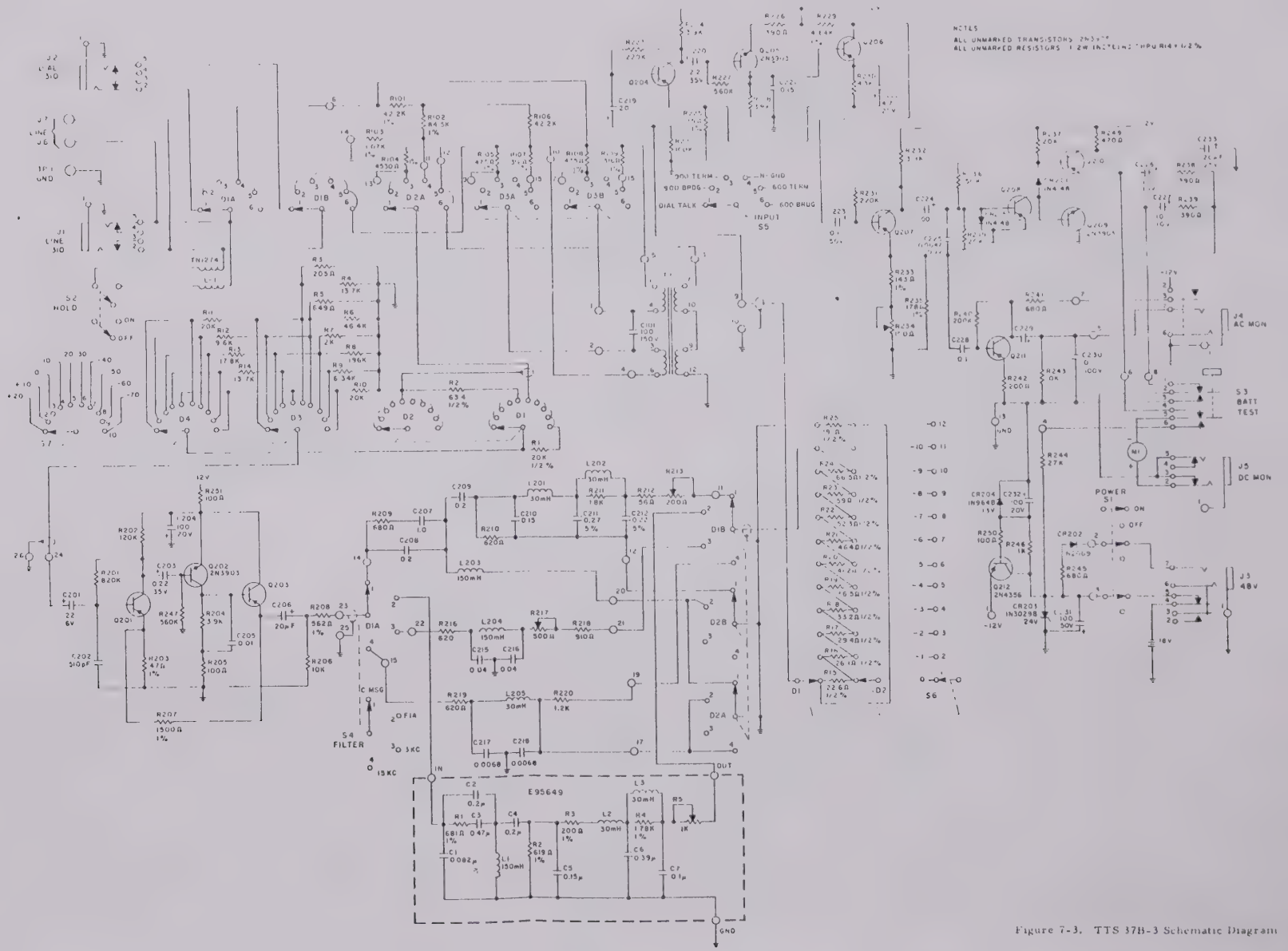


Figure 7-3. TTS 37B-3 Schematic Diagram

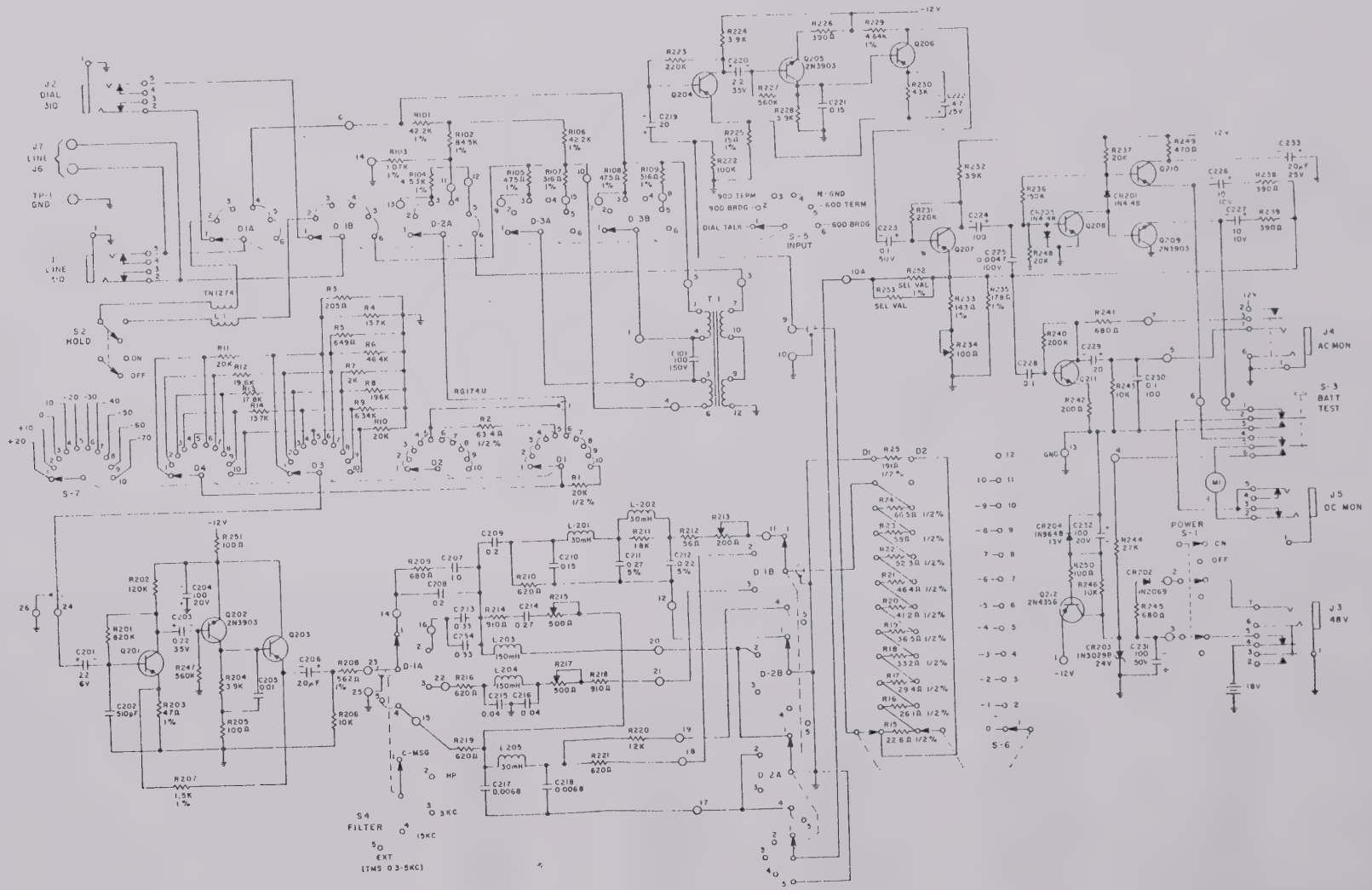


Figure 7-4. TTS 37B-15 Schematic Diagram

ADDENDUM SHEET TTS 37B-1

The TTS 37B-1 is a basic TTS 37B with an EXT position added on the FILTER switch and the hold coils wired differently across the LINE jacks so that the hold coils are not in the dialing circuits. When the FILTER switch is in the EXT position an extra 10 dB of gain is supplied by the meter amplifier.

PARTS LIST ADDENDUM

REF DESIG.	DESCRIPTION	MANUFACTURER (ESCM CODE #)	PART Number
S-4	S: switch rotary	71590	PA-1020
R-52	R: Sel. Val.	01121	RC20
R-53	R: Sel. Val.	07716	CEA

TTS 37B ADDENDUM 2

1. In paragraph 2.4, 15 kHz specification, change:

   13 kHz to 15 kHz; to read: 13 kHz to 16 kHz.

2. In paragraph 2.8a, change:

   0 dBm to read 0 dB.

TTS 37B ADDENDUM

Calculation of Signal to Noise Ratio

a. The signal to noise ratio for a given line is calculated as the ratio (in dB) of the lowest signal level expected at that point and the dBm equivalent of the weighted noise measured at that point. The "dBm equivalent" of the weighted noise is the noise power (converted to dBm) that would be measured in the appropriate bandwidth if the weighting filter was removed (assuming white noise). For example, C-Message Weighting reduces white noise in a 3 kHz bandwidth by about 2 dB. Therefore although

0 dBrnC (1 kHz) = -90 dBm,

0 dBrnC (noise) = -88 dBm (3 kHz).

b. In general, the signal to noise ratio can be calculated as follows:

S/N (dB) = Min. Signal Level (dBm) - dBm equiv. noise.

c. Sample calculations

1. Given

Noise = 21 dBrnC

Min. Signal Level = -16 dBm

Calc.

dBm equiv. noise = 21 - 88 = -67 dBm

therefore S/N = -16 - (-67) = 51 dB

2. Given

Noise = 21 dBrn (3 kHz)

Min. Signal Level = -16 dBm

Calc.

dBm equiv. noise = 21 - 90 = -69 dBm

therefore S/N = -16 - (-69) = 53 dB

TTS 37B ADDENDUM 1

1. Add the following note to the operating procedure:

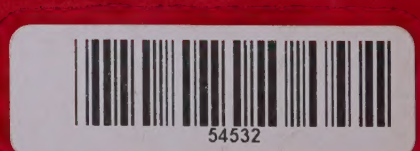
NOTE

The portable version of this instrument has been calibrated with the meter in the horizontal position and the rack-mounted version with the meter in the vertical position. To obtain the specified accuracy, the instrument must be operated in the same position in which it was calibrated. If it is desired to operate the instrument in another position, the instrument must be recalibrated while the meter is in the desired position.

2. Make the following changes to the E-14-037-20-006 parts list on page 6-3.

C207	C: 1.0μF	72982	8131-100-651-105M
C208	C: 0.2μF,100V	72136	1PJ-204F
C209	C: 0.2μF,100V	71236	1PJ-204F
C210	C: 0.15μF,100V	24446	AF12B1549D

ACCO USA
WHEELING, ILLINOIS 60090
25979
50505 25979
MADE IN USA
EXECUTIVE RED/ROUGE EX/ROJO EJE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